Wills Maclachlan

Proceedings of

Annual Convention

28th Year

of the

Canadian Electrical Association

Held at Ottawa, Ont.
June 21st, 1918

Office of the Association
12 Adelaide St. East
Toronto, Ontario

Canadian Electrical Association
Officers—1918-1919

PRESIDENT:
A. Monro Grier, K.C.,
Canadian Niagara Power Co., Niagara Falls, Ont.

FIRST VICE-PRESIDENT:
E. A. Dunlop, M.P.P.
Pembroke Electric Light Co., Pembroke, Ontario.

SECOND VICE-PRESIDENT:
C. S. Bagg,
Montreal Light, Heat & Power Consol., Montreal, Que.

THIRD VICE-PRESIDENT:
A. P. Doddridge,
Quebec Railway, Light, Heat & Power Co., Quebec City, Que.

HONORARY SECRETARY,
T. S. Young,
347 Adelaide Street West, Toronto, Ontario.

SECRETARY-TREASURER:
Wm. Volkman,
Toronto Power Co., 12 Adelaide St. E., Toronto, Ont.

ADVISORY COMMITTEE:
Composed of Past Presidents Eligible for Office.

MANAGING COMMITTEE

R. J. BEAUMONT,
Shawinigan Water & Power Co., Montreal, Que

P. T. DAVIES,
Southern Canada Power Co., Montreal, Que.

A. V. GALE,
Hull Electric Co., Hull, Quebec.

J. S. GOULD,
Citizens' Electric Light Co., Smith's Falls, Ont.

H. M. HOPPER,
New Brunswick Power Co., St. John, N.B.

D. H. McDOUGALL,
Toronto Power Co., Toronto, Ontario.

R. B. McDUNNOUGH,
Public Service Corporation, Quebec, Que.

W. H. McINTYRE,
Ottawa Electric Co., Ottawa, Ont.

J. F. NEILD,
Toronto Electric Light Co., Toronto, Ont.

J. S. NORRIS,
Montreal Light, Heat & Power Consol., Montreal, Que.

L. W. PRATT,
Dominion Power & Transmission Co., Hamilton, Ont.

H. E. RANDALL,
Shawinigan Water & Power Co., Montreal, Que.

G. B. WOODYATT,
Southern Canada Power Co., Montreal, Que.

THE PRESIDENT,
National Electric Light Association, New York.

CONTENTS

PROCEEDINGS

In accordance with the decision of the Managing Committee of the Canadian Electrical Association, a strictly one-day business session was held at the Chateau Laurier, Ottawa, on June 21st. Considering the general conditions and stress of the times, the meeting was very well attended; the papers presented were of a commercial and technical nature, covering the Association activities. The discussions were complete and very interesting and much information of great benefit was obtained by all. An informal dinner was held in the evening, which was addressed by the Past President, Mr. D. H. McDougall, Mr. John Murphy, and Mr. Munro Grier, K.C., the President for the ensuing year.

The President, Mr. D. H. McDougall, took the chair at 10 a.m.

The President: We will call the meeting to order. I notice the first thing on the programme is the President's Address. I must apologize for the rather random remarks that I propose to make.

The President's Address

As your presiding officer it is my pleasant duty to welcome you at this, the 28th Annual Convention of this Association.

It is usual on these occasions to review somewhat the progress of the industry for the past year, and this can be done shortly by saying that it was a year of activity on the part of the Central Stations which was unprecedented in the history of the Companies that form the bulk of our membership.

War Effects

The war, with its accompanying sacrifices and hardships, has made it necessary that each one of us should assume additional burdens and responsibilities. Our industry has had imposed on it additional duties in the way of operating problems and overloads that required all the skill, nerve and ingenuity that we could muster, and our staffs have been depleted further by conscription and the other war drains, making our responsibilities to our customers for the maintenance of service a very difficult matter.

I think I am safe in saying that we, the privately owned Companies, have met our obligations in the spirit of sacrifice that the war conditions demanded; that we have rendered real service to our customers whether understood by them or not, and in so doing have

done our bit to keep the industries of the country in their present prosperous condition.

Canada is in a prosperous condition, despite her mounting national debt, and this is evidenced by the wonderful success of her Victory Loans, which have been largely subscribed by her own citizens and which now amount to a total of $760,000,000. This is in addition to the various war funds such as Red Cross, Patriotic Funds and Belgian Relief funds amounting to $87,394,247.

To revert to our own problems: The first and probably the most important is the financial problem.

Few of us are able to finance any new extensions to our properties or even for maturing bond issues. This handicap has been largely met by charging customers the costs of line extensions and by intensifying our loads on present lines. Station increases have been almost impossible to finance. In some quarters this has been offset by taking on off-peak business, and this has required the study of factory conditions to educate customers to the necessity and possibility of such methods of operation. The result has been that higher load factors are experienced and some plants have been operated at a load factor deemed impossible even two or three years ago.

The next difficulty has been with our employees, whose numbers have been decimated by military service, to which they have willingly responded, and by conscription, which, I believe, has affected us in a minor degree to date.

I think I am safe in saying that great disorganization on account of these wholesale changes in staffs has only been averted by the loyalty and unselfish performance of duty of those who for one reason or other were unable to answer the call of the bugle.

One word about our duty to those loyal employees who have stayed behind with us. It is incumbent on the Companies to see that these members of their staff do not suffer financially for their loyalty. The operating and mechanical forces have been generously treated by the Companies. Can we say the same for the clerical forces, whose desertion at this time would tend to disorganization, and whose cost of living has increased proportionately to that of the other branches of the service?

Safety Devices

I would also emphasize at this time the duty of our Member Companies to protect their employees from accidents by every means possible. Many improvements in construction and operation methods could no doubt be employed that would eliminate some existing hazard to the men.

Time and care should be systematically provided for the training of the employees in artificial resuscitation. This has saved many men's lives, and can only be used in emergency by trained men. Even

the members of the medical profession are sadly lacking in knowledge with regard to the proper methods of bringing a man back to consciousness after electrical shock.

Coal Shortage

Some of our Member Companies who are dependent on a coal supply for the generation of their power have had the experience of many American companies, members of the National Electric Light Association, who have received only a portion of their usual requirements. Let me warn such members that I have it from an authoritative source that the conditions this year are expected to be even worse than during the past winter, and to urge them to store as much coal reserve as they are able to secure before cold weather sets in.

It is estimated that there will be a shortage of 50,000,000 tons of coal supplied from United States mines. This is attributed to shortage of cars and to increased demands, neither of which can be overcome in spite of the Herculean efforts that are being made. It therefore behooves us to do everything possible to cut down our peak loads by educational methods or otherwise, such as inducing our customers to use high efficiency lamps and our power customers to eliminate waste power in their factories, as well as to increase power factors, etc.

The question of rates for power is a serious one for many of us, as the cost of operation has increased in many cases from 50 per cent, to 100 per cent.

In the United States, where the rates charged by Companies are controlled by Public Service Commissions, there have been about 460 applications for increased rates. Of these, about 400 have been granted. There is no good reason why service should be rendered at less than cost, and no hesitation should be made in at least sharing this extra cost of operation with those who benefit by our service.

Power Shortage in Ontario

The outstanding example of failure to live up to its contract obligations in the service of electric power in Canada during the past year is the case of the Hydro-Electric Commission of Ontario, which, with an unprecedented lack of foresight, made contracts for large amounts of power it was unable to supply. The total amount of this shortage has been stated to be 100,000 horse power, but being unlike the members of this Association, it has so far been able to escape the consequences of this "selling short" of power, as it has refused to recognize the claims of its customers based on the solemn contracts signed by it, and has pleaded that its shortage has been caused by the war. It has hidden behind the skirts of its protecting parent, the Ontario Government, and has said to its customers, "You cannot sue the Government." "The King can do no wrong."

It is hard to believe that such immorality would be protected by

the Crown, and that millions of dollars invested in plants depending on Government contracts for their power should be shut down when many of them would otherwise be turning out munitions and other war necessities but for this breach of faith.

This Commission, in spite of its lack of business ability, is able to secure large sums for construction work amounting to about $2,000,000 per year because its undertaking is supported by the Government, although the works it is building cannot be of any service to the country for years to come, long after the war will surely be over. In the meantime it is diverting this money, so much needed for war purposes, from the use of the people of Canada. The amount of money expended by the Hydro-Electric Commission so far in transmission and distribution plants is about $70,000,000, and the estimated amount of taxes lost to the people, which they would collect from privately owned companies with similar properties, is about $1,500,000 per year.

General Remarks

I am pleased to say that our Association is in a flourishing condition.

You will hear later the Secretary's Report, which shows for the first time in years that we have paid all our liabilities and have on hand a satisfactory balance.

To accomplish this result has required a great deal of effort, and the Member Companies have responded heartily to the necessary calls that have been made on them for funds. We trust these special calls will no longer be needed, and that the regular fees will be promptly paid by all the members to prevent a relapse to our former financial condition.

If the Association can be made of service to the Member Companies in any way we should not hesitate to use it, as "In union there is strength," and we cannot hope to succeed if we do not know what others are doing along the same lines as we are following.

It is therefore urged by me that, whenever an operating or other problem arises, either the executive of this Association or the Secretary of the National Electric Light Association be communicated with to see if assistance can be rendered.

My special thanks are due to Mr. Gilman, our present Secretary, who has done splendid work since December last, and largely through whose efforts the Association is able to present so good a financial report.

One word about our affiliated brethren, the National Electric Light Association.

They have just held one of their most successful and inspiring conventions at Atlantic City. I am sorry that more of our members were not in attendance.

Mr. T. C. Martin, the Secretary of the National Electric Light

Association, has kindly come to attend our session and to represent the Association. He will address us later and tell us something about the Convention.

The President: We will now hear the Report of the Secretary-Treasurer.

Report of Secretary-Treasurer, Year 1917-1918

To the President and Members of the Association:—

Since assuming the duties of this office, December 1, 1917, special and consistent endeavors have been made to improve the financial position of the Association.

Last June it was seen in all likelihood for the coming year that the comparison of expected receipts with known and expected liabilities would show a heavy deficit.

Accordingly, various Member Companies agreed to continue their special subscriptions for another year, and special effort has been made to increase our collections of dues, in order to bring that source of revenue as high as possible.

The financial and membership statement for the past year will be presented at the Class "A" Executive Session.

A considerable increase in our Class "B" membership is to occur shortly, due to the formation of a new Company Section with one of our Member Comanies.

In closing I wish to thank all the members for their welcome co-operation.

Respectfully submitted,
M. C. GILMAN,
Secretary-Treasurer.

The President: Any correspondence?

The Secretary: No.

The President: I will ask Mr. T. C. Martin, the Secretary of the National Electric Light Association, to address you. Mr. Martin, as you know, is a sort of father to the industry, and knows all about it from the beginning to the present time, and is heartily welcomed by us to this Convention. It is with great pleasure that I give the floor to Mr. Martin.

Address by Mr. T. C. Martin

Mr. T. C. Martin: Mr. President and gentlemen of our sister Society, the Canadian Electrical Association, it is needless to say that it affords me a great deal of pleasure to be amongst you once again, to renew friendships and acquaintanceships which are very dear to me.

I have recently been travelling a good deal in the company of your worthy President, and I can assure you that at our Convention in Atlantic City he was certainly one of the stars. (Applause). Associated with all the special warmth of these strenuous times, when

we are thrown together and working together as Allies, comes the fact that Mr. McDougall has long been one of our members, and that on the present occasion he brought to our attention some of the splendid work that has been done and is being done in Canada for the care of those who have been injured and disabled in doing their bit at the front. In this respect, as in many others, we find that we are learning a great deal from Canada. Canada got into the war very early and learned her lesson very quickly, and we find that Canada has a great deal to teach us, and we are sitting at her feet. She cannot teach us much on the score of patriotism, but along the line of knowing how to fight and how to taks care of those who have been in the fight, we find that Canada has a great deal of useful and valuable experience from which we are only too glad to benefit. I speak advisedly in that respect as I happen to be associated with some of the movements in our own country.

Year's Work of N.E.L.A.

We had a very interesting and inspiring meeting at Atlantic City, at which, as on this occasion, our affairs were gone over and, as here, our attendance was somewhat limited. Those who have been to our pre-war conventions know that it is nothing for us to run up to an attendance of from 4,000 to 6,000. At Chicago, three years ago, we had nearly 5,000. This year at Atlantic City we were slightly in excess of 300, but there, as here, while perhaps we missed the enthusiasm and excitement which comes from the hurly-burly of a big crowd, we had the advantage of having men who were executives and prominent in the management of great public utility institutions. So that while we may have lacked in number, I do not think we lacked in any other respect.

The National Electric Light Association has been going through a strange and interesting evolution, probably inevitable, due to the condition of the times, and if I touch on one or two of the high spots I think it may be interesting and illuminating. A great deal of our work—from which has proceeded our valuable annual proceedings, running to four and five volumes—a great deal of that work has been done through committees. We have seventy standing committees, and those committees in the past have met anywhere from 100 to 150 times in the administrative year. Last year those seventy committees had 28 meetings. The result was that a great deal of the work had to be conducted by correspondence, and that very few of the usual annual reports were available or were presented or will be printed. In some respects the industry must suffer from the lack of those valuable reports of progress, but we are all of us so busy in other directions, principally along that of winning the war, that there are several compensations in this respect. If the men have the information as fully as before, they are not in a position to utilize it.

This has brought about a somewhat interesting condition that, due to the smaller amount of work connected with such meetings—nearly all held at headquarters—and due to the reduction in incidental expenses, our annual budget of about $200,000 a year has been cut during the past year to the tune of about $65,000. And it is perhaps just as well that should be so, because our income has been reduced proportionately, and that reduction has come about in a somewhat singular but natural way. We have a membership today of not quite 12,000. Before America went into the great war we had a membership of approximately 15,000. Our total net loss of class B and E members, individual members, during the past year, was nearly 4,000, at $5 per member—there is a loss in that one item alone of $20,000 in income. And probably this year the loss will be intensified from the fact that the drafts are still in operation and a great many of our members and employees of our member companies are still getting into the game. I am very glad, indeed, to be able to state that a very large percentage of that 3,400 loss in membership is a loss to us but a gain to the cause. A great majority of those men are in the naval or military service of the country and our member companies, including those men, have put nearly 15,000 men into the line. (Hear, hear, and applause). I am very glad to say that my own son, one of our National members, is in France doing his little share. (Applause).

We have been active in some rather unusual ways, to which I would like to direct your attention, because the line of cleavage runs right across your own affairs. But before doing that I would like to mention, and I am glad to note that the subject will be brought directly to your attention by Mr. Maclachlan following me. We have revived our campaign of resuscitation from shock, a subject to which your President just referred so pertinently. This is resuscitation of resuscitation. (Laughter). This is the third resuscitation campaign that we have had, and I will leave Mr. Maclachlan to go into the details, of which he is so completely a master. But I would like to say that we are taking up this work again not only because we are ready to do it, and feel that it is a patriotic obligation, but because of the immense pressure brought to bear upon us by the authorities of America to bring our rules and practice in that important respect absolutely up-to-date. And, as President McDougall said, it is not only with regard to the education of our own people, officers and employees, that we are concerned, but really a great deal depends upon the higher and better education of the medical practitioners, upon whom we must depend in the last analysis.

War Work of N.E.L.A.

Our work during the past year has centred and converged around and upon problems directly connected with the war. And to deal with

those the work of the central office in New York City has been, in a sense, sub-divided by the creation of two extraordinary committees, with the work of which you are doubtless more or less familiar, but possibly have not had the matter brought to your attention so directly as I am now doing. I do not know to what extent you have done analogous work in this country, but we are getting a great deal of satisfaction out of the effort and are spending a great deal of money in that work. I wish it might benefit you more directly than it does, but with us it is a cause of constant effort and of continuous expense.

N.E.L.A. Committee on Gas and Electric Service

We have established and are maintaining two Committees in Washington, but with very different functions. One of those is the National Committee on Gas and Electric Service, and I am glad to know that it has been a great deal of use to our public utility members in Canada, particularly with regard to meeting coal situations and coal difficulties. When I tell you that that Committee has handled in a single day in Washington on appeal by letter or telegram or long distance telephone no fewer than 200 applications for help to get more coal, or gas, oil, you will realize that that Committee is a busy one. And while I am not reflecting on the desire of my office to do its share, I am a little bit glad that that Committee is in Washington and attending to its own job. (Laughter). And it certainly is, with our President at the lead, Mr. John W. Lieb—who has given most splendid patriotic service, to the point of physical exhaustion—and with Secretary Mr. George W. Elliott, whom you all know more or less as our very efficient and diplomatic master of transportation—a Canadian. (Applause). And I can assure you that he has found his place in Washington, where he does such admirable service and is hobnobbing to such an extent with all the powers that be to our advantage, that I would not be very surprised that he meets with some call to return to his native land and occupy himself at Ottawa. It is curious the extent to which that Committee has carried on its work, and perhaps we have done something you might not very thoroughly or highly approve of—we have gone to the help of several municipal plants in an emergency. We had to—just as you have done—help out this hydro-headed Commission that you have here. (Laughter). We felt that in doing that we wanted the National Electric Light Association to represent in the mind and in the eyes of the authorities at Washington the light and power industry of the United States. In that respect I think we did what was right and what was proper. It was not merely helping out municipal plants that we were called upon, but in some instances municipalities found themselves in dire distress. While Mr. McDougall and I were in Atlantic City during our past Convention we were very glad indeed to hear Mayor Bachrach, of that city, come out frankly and thank the

National Association through its Committee on Gas and Electric Services, for securing coal which enabled its water plant to remain in operation last winter. (Applause). That Committee is in the closest touch with our Fuel Administration, and I can state, confidentially, perhaps—there is nothing to conceal about it—that Dr. Garfield sits into our meetings quite frequently, and that our Secretary is virtually a member of the Coal Board, and in that way we are enabled to do a great deal of work, and feel more hopeful than we might otherwise feel about the conditions which confront us during the coming critical year your President has just referred to.

Coal Situation

According to the figures which we have—and which were confirmed by Mr. Noyes, the Conservation Director of the Fuel Administration, who spoke at our dinner a week ago—the needs for coal in the United States during the coming year will be 700,000,000 tons, a considerable portion of that being directed and diverted to Canada. The utmost production we can count upon at the present minute is 650,000,000, leaving a deficit, as Mr. McDougall states, of about 50,000,000 tons. It has been endeavored to meet that in various ways; one being the interconnection and interlocking of various generating systems. Another, which has seemed drastic and is meeting with a great deal of opposition, is putting as many isolated plants out of business as possible. You all know the absurdly high ratio of fuel consumption on which they operate, and already a great deal of work is being done along that line. In New York no fewer than fifty of the larger isolated plants have been recently hooked up with the local central station company, and it is purely on that fuel basis. We are also confronted with such measures—with regard to which I have had correspondence with several of our member companies in Canada, as the cutting down of sign lighting and vanity lighting, and lighting of that character. At the present moment Broadway is in full blast, and I am glad to say that Coney Island is no longer on the blink. It was a scene of desolation quite recently to go along that coast and see nothing doing in that respect. But probably in the early fall once more the restriction will not be imposed so rigorously and places of amusement may enjoy that amount of extra illumination which really in the long run consumes so little coal.

We are now confronted with a new proposition, which was afoot within the last week, something along the lines of what they have had to confront in England and France, and that is the restriction of the domestic or private consumer in the amount of current to be used for light, heat or power, thus releasing a certain number of units for employment in industries of various kinds, particularly in the production of munitions. Now, those peaks do not overlap, and a great deal of thought and attention is being given to it, but it seems

quite on the cards during the winter we in America will see some restriction or regulation of that kind passed. And I can assure you in that respect, as to all others which it has given attention, our National Committee on Gas and Electricity is on the job very much.

I would like to say that that Committee is at your service. I hope you won't get into difficulties which might compel you to send distress cries, but if we can help you, please let us know it, and I can assure you we will only be too glad to do what is possible.

N.E.L.A. National Committee on Public Utility Conditions

The other Committee is of a somewhat different character and scope, the National Committee on Public Utility Conditions. I hardly like to characterize that as a political committee, as it would not be exact or quite fair. But it is notable that while the other Committee on Gas and Electric Service limits its attention and energies largely to the governmental departments and bureaus, the Committee on Public Utility Conditions has found a very noted sphere of work at the other end of Washington Avenue, where Congress sits. The Gas and Electric Service Committee has been of infinite use to the Government, as, for example, in the equipment of cantonments with light, heat and power and securing of service in various ways which the Government needed in a great hurry, especially in the equipment and operation of new munition factories.

The National Committee on Public Utility conditions has had its attention rivetted to two main subjects. One is rates and rate increases, and the other the securing of necessary capital with which to carry on the industry. Your President has summarized the figures which have attended the general movement for rate increases in our country. Taking public utilities as a whole, there have been this year very nearly 700 rate increases; that including a good many cases where street railway fares have been jacked up from 5c to 6c or higher. In our own field, some of the rate increases have gone as high as from 23 to 25 per cent.; as, for example, at San Diego, California. A great deal of that work is due to the activity of our Committee in Washington. But it has done a little more than that. It has brought the subject to the attention of the higher authorities, and during the past winter we were enabled to secure letters from President Wilson, Secretary McAdoo and the Comptroller of the Currency, Mr. Williams, recommending, suggesting, and virtually requesting public utility commissions throughout the country, and every person in authority on the subject, to grant rate increases without delay. We have not by any means ceased our effort in that respect, but it is needless to say that with a commendation of this kind from the highest authorities in the land, a great deal of weight and importance has been given to our movement which it would otherwise not have enjoyed; and it has come with all the more weight and effect from the recog-

nition of the value and importance of the utility and the fact that we are recognized not as a little local public utility operating in a small given area, but as a great national industry, the welfare of which is highly essential to the one thing, which will appeal to you more than anything else, winning the war. (Applause).

The other angle or aspect of the work of that Committee is that vital one of not only securing capital for extensions, but for hanging on to the capital which we have got in the industry. At the present moment, within another week, something like $200,000,000 of obligations mature. And it is needless to say that public utilities are not in any position to raise new money to take that up. They have got to be extended or taken care of. During the past winter, legislation in Congress resulted in the enactment of what is known as the War Finance Corporation Law—a law which the National Electric Light Association had a great deal to do with putting it on the statute book. But we were rather disappointed when it came to the application of it.—a fund of $500,000,000 for the assistance of industries, and we presumed that utilities which needed assistance would be given assistance. The administrators of that law felt that it would not be wise or proper for them to immobilize a large proportion of that money in public utility securities which could not be liquidated easily, and only in extreme cases were they willing to come to the assistance of utilities whose obligations were maturing. One case I can mention, that of our member company in New Orleans, with some $6,000,000 or $7,000,000 to take up immediately. The War Finance Corporation decided that it could not interfere in the matter, although the Governor of the State and the Mayor and the Corporation Counsel of New Orleans came to the support of the proposition and endorsed it heartily. On the other hand, just as I left New York yesterday, I was glad to note that the War Finance Corporation had come to the assistance of the Brooklyn Rapid Transit system, which has some $57,000,000 obligations coming due almost immediately, and has agreed to take up in its behalf some $17,000,000 of that amount.

But a more hopeful step has been the formation by the bankers themselves of a pooling fund, represented in a special corporation, with a capital of $100,000,000, the whole of which is to be devoted to the assistance of public utilities. We had some very important meetings in New York, and we politely and diplomatically gave the bankers to understand if we were not assisted in some such way as this, why we would form a co-operative bank or fund of our own, which could be easily financed to that amount and would, so to speak, make us more independent of the banks—to that extent at least. Now, the bankers are proposing, according to the plans which are published but not given in detail, that they will devote this fund to taking up the maturing obligations of the public utilities under Section 7 of this War Finance Corporation law. And the War Finance Corpora-

tion law permits the directors of the fund of $500,000,000, to re-discount for the bankers that paper up to 70 per cent.—so that all that the bankers tie up in that respect is 30 per cent. And it is believed that in this way the relief may be secured which we so greatly need. and which can be secured only in some such way. It is obviously necessary that relief should be granted. It is obviously desirable that the bankers should assist the public utilities to prevent what might well impend in the shape of general financial disaster. If the public utilities, in whose securities so many of the banks are deeply interested, were allowed to go to the wall, it would not end there.

That has been part of the work of this Committee, which I am telling you in confidence—practically few or none of its details have been made public—but it was felt by the President and myself that this sister Association might well be acquainted with what we were trying to do in Washington along these lines.

With regard to rate increases, I said that we had not finished our work. And at Atlantic City I published a pamphlet, which is already being sent to all member companies; it is a compilation of some hundred rate increases in our industry made during the past year—a pamphlet of nearly 100 pages, in which a great many details are given of rate increases, and as to coal clauses and other features. If you gentlemen do not receive those copies I shall be very glad to hear from you and fix you up to the best of our ability.

There is one matter which we dealt with at Atlantic City, and which I urged your modest President to bring to your attention himself, but I was not successful. We had a very patriotic meeting. It did much to intensify the enthusiasm with which we are confronting the great problem of beating the bloody Hun, and it strengthened us in our resolves to stand privation and endure to the end. In the Report of the Committee on the President's address—which, by the way, was a masterpiece and went to the extreme of your own President, because while his occupied seven and a half minutes, Mr. Lieb's occupied 62 minutes by my watch. That is being printed, and you will get copies of it just as soon as I can get it through the press. The Report of the Committee on this magnificent President's address included a Resolution of fealty and of loyalty. It was the desire of President McDougall, as it is the desire of President Lieb—whose best wishes I bring with me—that the Resolution should be brought to your attention at this meeting, and as your President would not read it, I have his permission to do to.

The President: Instructions. (Laughter).

Mr. Martin: I obey your order. (Laughter). The Resolution is as follows:

> "RESOLVED THAT: The National Electric Light Association in annual convention assembled, desires to extend to the President of the United States and all others in authority

the assurance that in its organization and its membership it is in thorough accord with the fixed determination of the American people and their chosen representatives to prosecute the war with the utmost vigor and to a victorious conclusion, —however long it may take and however much it may cost them in men, money and other forms of sacrifice.

"The goal we seek through the prosecution of the war is the winning of a great Peace—a peace so well established that it cannot lightly be disturbed by autocratic force wedded to the doctrine that might makes right. For such an end of the war we are ready cheerfully to submit to such further restrictions of personal and corporate activities, and to such further burdens upon private and corporate property and business, as may be found necessary to impose upon the people and industries of the country.

"We recognize as the one great menace of the future the possibility of an inconclusive peace—an armed truce which would inevitably end in a renewal of the unspeakable horrors of the present war. That must not be, and the only way to prevent it is to carry this war to Victory—a victory so complete and overwhelming that the forces of evil will be glad to accept such terms as an outraged world may be willing in justice to accord. No compromise, no half-way measures, no patched up "scraps of paper" can accomplish this great end; but only the devotion, the patience, the self sacrifice and the undying patriotism of our people and their great Allies.

"With a realizing sense of the stupendous sacrifices, but with an abiding faith in the ultimate result, we pledge all that we have and all that we are to the Holy Cause." (Applause).

I had the honour of transmitting that to the White House, and within twenty-four hours of receiving a most appreciative, kind and sympathetic response from President Wilson himself. (Applause).

I am very glad, indeed, to have had the privilege and honor of reading that resolution here and of congratulating you upon this magnificent showing that the Canadian people and nation has given to the world and the great example to us, loyalty, patriotism and determination to see the battle of civilization seen through to a finish. (Great applause).

A. Monro Grier, K.C.: Mr. President, I rise with a particular object, but before alluding to that, if you will pardon me, I would just interject a word or two, because I do not see on this programme any opportunity to discuss the report of the President and Secretary. Perhaps there will be such an opportunity, and for that reason I am only going to say a word or two.

I wish to say that it gave us the greatest possible pleasure to

listen to such a report as you gave us this morning. I wish at the same time to refer to the excellent work of the Secretary-Treasurer in bringing us to such a fine shape as we are in.

I now have the honour of proposing a vote of thanks to Mr. Martin, not only for his address to us this morning, but for his being here with us once more. The fact of the matter is that any language which I might make use of would only render him uncomfortable, if I spoke all that is in my heart. But I can perhaps sum it all up when I say this: That in Mr. Martin we feel and recognize once more that he is a fit representative to bring to us such a resolution as he has just read from the Electrical Association of the United States of America. Mr. Martin's keen appreciation and analytical power will enable him at once to see that in using such language as that I have said much more than if I had spent minutes and perhaps hours in commendation of him. It is a very great pleasure indeed to see him and meet him once more; it is, as I say, an added pleasure since he comes bearing such a message.

We are at one with the Americans in this splendid address they have made. For my own part, I do not recall having listened to a resolution by any body of men which seems to me so tersely, so finely, so fittingly to represent the spirit of those of us who are really loyal as does this resolution which we have had the pleasure and honour of listening to. I admire, I wonder at, and I am immensely pleased, as we all are, with such a resolution. It is not only that in spirit it is fine but that in form as well it is splendid. It seems to combine the fine depth of feeling which we all have, with wonderful terseness and vigour of expression. It really shows to a world what the English language can do. It demonstrates once more, that whilst there may be other languages which can do great things, when it comes to the matter of expressing deep, fine feelings, this old language which Shakespeare spoke, and which our two countries share in common, is a language which is fitted to describe the highest emotions, the most wonderful of feelings. Again, for my own part, I confess that I am deeply moved by hearing one's own thoughts, as it were, so wonderfully and as fittingly uttered for us all. It is with the greatest possible pleasure then, sir, that I move a very hearty vote of thanks to Mr. Martin for his address to us this morning. (Great applause).

The President: Gentlemen, I do not know whether it is necessary to put that motion, but I would ask you to carry it by a standing vote.

—Motion was carried by a unanimous standing vote, with great enthusiasm.

The President: Mr. Martin, I have much pleasure in extending to you the hearty vote of thanks of this Association.

Mr. Martin: I am only sorry that by my side at this moment does not stand that fine expression of the German race embodied in

the President of the National Electric Light Association, a man whom we all love and esteem, John W. Lieb. (Applause).

The President: I am sure that the members will thoroughly agree with me that it was fit and proper that Mr. Martin should read that resolution, and that coming from him it was much more appropriate than if I had read it.

As the time is going on we will proceed with our programme. I understand Mr. Wilson has been unable to get here and consequently his report on Prime Movers Committee Report will be passed over, and I will ask Mr. Maclachlan to give Accident Prevention Committee Report. It is a very important subject, gentlemen, and I am sure we will be glad to have Mr. Maclachlan present it to us.

Report of Accident Prevention Committee

Wills Maclachlan, Chairman

Mr. Chairman and gentlemen; this year we have not prepared a Report of the Accident Prevention Committee, in that some of the most important matters that we could present before you are in a state of preparation by the Accident Prevention Committee of the N.E.L.A. The important points being the standard for belts for linemen and a standard method for the specification, purchase and testing and care of rubber gloves. This will be presented in the N.E.L.A. Report which you will all get.

In looking over the matter, though, I felt that a presentation of a demonstration of resuscitation from electric shock would be of some value and interest to you, as I find that very few electrical men know really how to bring a man around from electric shock. In carrying out the work in Ontario we have trained possibly thousands of employees, and we have successfully resuscitated a number of men since the 1st of January, 1915. Five of those men have been resuscitated since the 1st of January, 1917, four from electric shock and one from drowning.

Mr. Martin spoke of the third commission on resuscitation that has held its first meeting in New York. Its proceedings will be put before the medical fraternity in their journals, and I do not wish to anticipate them, but anything that I show you here will be supported by the resolutions that were passed in New York. On that commission are represented the Rockefeller Institution, Harvard University, Yale University, Johns Hopkins University, Western Reserve University, Public Health Service of the United States, and Surgeons General of the Army, Navy and Ordnance of the United States, together with certain industrial surgeons such as Dr. Lauffer, of Pittsburg, and Dr. Schubmehl, of the General Electric Company.

Let me explain briefly the way you breathe—First, right across your body is a diaphragm; above it is the heart and lungs; below it

the stomach, liver, spleen and the intestines. In breathing that diaphragm moves up, compresses the cavity above the diaphragm, compresses the lungs and forces the air out of the lungs. Then it drops down, causes a partial vacuum in the cavity, and the lungs enlarge and the air goes in the mouth and nose. In the case of electric shock the nerve centres that are operating this diaphragm are paralyzed, and the nerve centre that is operating the heart is weak; these cause you to have a suspension of the breathing and a very weak heart. What we do is to bring pressure to bear on the liver, spleen and stomach, and force the diaphragm up and force the air out. Then we release—these three bodies fall back into place and the diaphragm comes down and the air goes in. In that way we are simply duplicating or simply carrying out what nature does with you in breathing. We also bring a certain amount of pressure to bear on the spleen and force the blood into the heart—in the nature of priming the heart.

I will now show you a demonstration of training two men who have not had any training in resuscitation—this is just the way that I do it in the power companies, and then we will have a gang put on a resuscitation as it can be done by trained men. After which, if there are any questions to ask, I will be most pleased to answer what I can.

Demonstration of Resuscitation Applied

These men have come right from a job. I wanted to show it in the real method that is carried on. These men are employees of the Ottawa Electric Company who would not normally be required to perform resuscitation. All the employees of the company that would normally be required to perform resuscitation can do it. We have tried them all out.

If you would lie down on your back. (Man lies down on floor). Turn man over on his stomach. Clear the mouth of any chewing gum, tobacco or false teeth. Put arms over head one bent at elbow and rest head on it. Grip the man as if you were gripping a horse, straddling him, with your knees just behind trousers pockets. Then put your hands in the position shown in Figure 1, fingers over lower ribs, little finger on lowest rib, tips of fingers out of sight, stiffen your arms and rock forward on your knees, bringing pressure to bear as shown in Figure 2, then back relieving pressure. Continue this operation, taking the time from your own breathing. (Demonstration put on).

Now say I am tiring in carrying this on. The way you change over to man relieving is to put your hand just where this right one is, press down, back, (man relieving straddles victim) down and back, down and back. New operator is now in position and old one gets up.

Now, the next man would normally come here, loosen the collar, and take a hand axe or stick about the size of a baseball bat and ham-

Figure 1

Figure 2

Resuscitation by Prone Pressure Method
(See page 22)

mer the man's heels, which is, in a way to imitate a fall, or give a shock to his nervous system.

A Member: How long do you continue that?

Mr. Maclachlan: Continue that for three hours and a half or until the onset of rigor mortis or the cooling of the body after an application of heat.

A Member: Do you take off the shoes when you hit the feet?

Mr. Maclachlan: No, leave the shoes on.

A Member: That work on the heels continues throughout the whole three hours?

Mr. Maclachlan: No, about twenty times and then stop. Let it go for a few minutes and then repeat.

Now we will have this done by trained men from the Ottawa Electric Company.

——The men from the Ottawa Electric Company give demonstration of resuscitation.

Mr. Maclachlan: Taking the belt off first thing because it fouls a man in carrying on resuscitation. Opening the mouth. A man going for the doctor.

A Member: How long does an individual keep at that process?

Mr. Maclachlan: Keep at it about ten minutes. I have had men keep it up far longer than that. It is not tiring. A man bringing back a medical kit. He is supposed to have been to the line wagon and got his first aid kit. He has telephoned for doctor and brought back a hand axe that they did not happen to have with them.

——The other man takes over the process of resuscitation.

Mr. Maclachlan: Opening the medical kit and taking out vaporale of ammonia. Puts it for the man to breathe. Taking the hand axe and hitting the feet. You will notice the man takes his hands right off the patient to give the body a chance to extend to its full.

——The men who put on the exhibition of resuscitation were given a hearty round of applause.

The President: Before these men go I would like to thank them for their part in the demonstration.

Mr. Maclachlan: You will possibly find that your medical fraternity knows little about resuscitation from electric shock or the help that they can give. If you want to advise any doctors by telling them where they can get information tell them to look up the British Medical Journal of March the 1st, 8th and 15th of 1913, and American Medical Journal of July 1st, 1916; they will find good information. The best book on resuscitation is a little book prepared by Dr. Lauffer, of the Westinghouse Company, in Pittsburg, and is published by John Wiley & Sons. There is a Report of the Bureau of Mines, U. S. Government, giving a great deal of information from their Advisory Surgeon, Dr. Yandell Henderson, of Yale.

Mr. Grier: Generally speaking, do you find the medical men hospitable to any suggestions you make?

Mr. Maclachlan: I have found them very hospitable. I do not do it publicly, of course. I have trained possibly 100 to 150 doctors in their own offices. That is the best way to deal with it, bring it up in casual conversation.

Mr. J. S. Gould: Is that more effective than pulmotor?

Mr. Maclachlan: Yes sir. I am not using pulmotor and will not demonstrate or teach a man how to use the pulmotor.

Mr. J. S. Gould: Why ?

Mr. Maclachlan: Because it has not saved one life in Ontario from electric shock.

Mr. J. S. Gould: Why?

Mr. Maclachlan: Because it does not get the air and combination of air and oxygen into the base of the lungs. That is one reason. Another reason, that it is not usually on the job when you want it, and the loss of five minutes, a man will usually die in that time. Another thing, I have not been able to train employees in the use of the prone pressure method if there are pulmotors available for their use, or if the company back of them is suggesting the use of the pulmotor. The largest companies now have disregarded the use of the pulmotor. They have either got them in storage or have sold them.

Mr. J. S. Gould: I was not defending the pulmotor; I was only asking for information.

Mr. Maclachlan: I am glad you did because I wanted to bring out that point. That also includes the lung motor, and there are half a dozen others that are not very well advertised.

A Member: Would you use prone method for gas poisoning?

Mr. Maclachlan: Yes sir; if you will use a tank of oxygen with face mask and feed it fairly close to the mouth for about the first 20 minutes and then disregard the oxygen. The oxygen is only of use in gas poisoning cases for about the first 20 minutes. If you have not got it, you have a lot of oxygen in the air, and if you will work a man a little faster in a gas poisoning case than I was working him, you will usually bring the man around.

A Member: The pulmotor has been proven to be of apparent use in gas poisoning.

Mr. Maclachlan: Well, this Commission I was speaking of are not advocating it. They are advocating the use of the prone pressure method. In mine cases, which are very similar to gas poisoning cases, the Bureau of Mines is not recommending the use of the pulmotor, but is recommending the use of the prone pressure method with simple scheme of oxygen tank with gas mask.

A Member: Is that the same system used in the case of drowning?

Mr. Maclachlan: Exactly the same system. In this method you

do not have to roll the man. The first pressure you give out comes the water.

In one company we had the case of a man in a diving suit; when underneath the water the face mask became loose and water got in. They pulled him out, took eight minutes to get his suit off; by that time the pulmotor was there. Used it for about three minutes; were getting unsatisfactory results and disregarded the pulmotor. Threw him over on the face and carried out this method. The mucous and water came out during the first three strokes and he revived in about nine minutes.

The President: Before proceeding with the next number, you probably have had some notice of this evening's dinner. We expect to have an informal dinner to-night, and we would like you all to get there about a quarter to seven so that we may get started about seven o'clock. We hope everybody will be in attendance, as this is a get-together session, and this is one very important means of getting to know each other.

I will call on Mr. Dion to read the Report on Overhead Lines Committee.

Mr. A. A. Dion: Mr. Chairman and gentlemen, I am afraid you will be disappointed with the results of the Committee on Overhead Lines. This Committee at the start realized that the work on Overhead Lines had been taken up in such a serious and complete manner by the N.E.L.A. for years past, and has done such an immense amount of work, under facilities which we could not command, produced such results, that there seemed little we could do without overlapping and going over the same ground—only in a less capable way. The Overhead Committee of the N.E.L.A. has brought out, as a result of years of deliberation by the very best men in the industry, a manual or handbook on Overhead Lines Construction. This has been added to and corrected and brought up to date, and the work is so very complete that this year's Committee of the N.E.L.A. has found—of which, by the way, I have the honour of being a member, and which carried on its work by correspondence during the past year in order to economize, as all the other committees are doing—hardly anything to add to what had already been said on the subject. Therefore, there was very little that this Committee could undertake. However, to show our good will, we thought we might cover the ground by inviting questions on special things, asking members if there was any special point on overhead construction they would like to know about, and we would endeavor to have the questions answered; this has brought out a few questions, some of which are old, and which have been already treated, and discussed very fully. But such as they are, I am going to briefly go over these questions, together with the answers which the members of the Committee furnished.

Report of Committee on Overhead Lines

A. A. Dion, Chairman

To the Members of the Canadian Electrical Association.—
Gentlemen:—

Your Committee on Overhead Lines, being aware of the great work that has been done by Committees of the N.E.L.A. on this subject, the handbook on Overhead Line Construction that has been published by that Association, etc., felt that it would be useless to attempt to go over the same ground, and thought that if there was any use at this time for a Committee on Overhead Lines in the C. E. A., it was that such a Committee might take up special questions which might be raised by the members from time to time. Questions were invited, a number were received, and the membrs of the Committee were asked to give answers to them.

This report, therefore, consists of these questions, with a summary of the answers given. It is not claimed that there is anything particularly new about it; the questions treated have all been treated before; however, the report is presented for what it is worth. If it is of use to even one company in this Association it may justify itself.

Inquiry Re Outdoor Disconnecting Switches

It is asked if improvement is not needed in outdoor types of disconnecting switches. It has been found in some instances that switches operated by means of cranks or swivel joints, when made of iron, rust and seize unless frequently used. To test and overhaul these so that they will always be operative necessitates disconnecting the lines, and in that case the switches become a nuisance rather than a convenience.

Replies

One member has between 200 and 300 swivel outdoor disconnecting switches on a 40,000 volt line, and has not found that the bell cranks ever seize owing to infrequent use. The main difficulty has been in the contacts. Of course, like any other piece of apparatus, the switches require a reasonable amount of care if one is to get the best service from them.

The member has found that in outdoor switches it is essential that exposed moving parts be made of non-corrosive material, in order to avoid the trouble complained of. Copper plating of bolts, nuts, etc., to eliminate corrosion, has not been found satisfactory.

The member says he is not using switches with bell cranks but just the ordinary knife blade switches, opened by means of long wooden sticks, the man using rubber gloves. This has been found satisfactory up to, say, 25,000 volts, but above this it becomes perhaps rather dangerous to open such switches in wet weather.

Inquiry Re Grounding Secondaries

The member asks the "hardy perennial" questions regarding grounding secondaries, whether they should be grounded to water pipes, rods or cones, and if ground rods or cones are used whether they should be embedded in coke, what resistance to ground may reasonably be expected; whether the same ground wire should be used on 2200 volts for lightning arrester and transformer secondary on the same pole; whether the ground wires on the sides of poles and buildings often break; if it is worth while using stranded cable; and whether the ground wire should be insulated or bare.

Replies

One member answers as follows: The grounding of secondaries to water pipes can only be decided with the co-operation of the city authorities. Failing this, cones and rods must be used. It has been found very difficult to measure the resistance to ground, and so it could not be determined what might reasonably be expected. It has been the member's practice to install separate ground wires on 2200 volt circuits for lightning arresters and transformers. The idea being that in case of current going to ground from primary through the lightning arrester there will be enough resistance between the two cones in the ground to prevent a very high voltage being impressed on the secondary system. Ground wires running down the sides of buildings have occasionally been burned off but stranded wire would not help in such a contingency.

A member states that grounding by means of rods or cones should never be practiced unless water pipes or other continuous piping systems are not available. The resistance through a ground rod or cone is extremely variable; it may be anything and cannot be depended on. Water pipes are recommended after extensive experience. If ground rods must be used, some hydroscopic material should be used to keep the soil moist in the vicinity. If the ground is good and reliable the same ground wire may be used for all purposes. The member does not use ground wires on the sides of buildings and refers to the fact that this matter is fully covered by the inspection rules in Ontario.

The member claims that without doubt the water pipe makes the best ground and states that there is a wealth of information published regarding the resistance of ground connections of various kinds. In his opinion it is much better to use two separate ground wires from lightning arrester and secondary of transformer. His experience shows that ground wires are sometimes broken by mechanical means, but more often at the ground line through electrolysis or natural corrosion. With a single ground wire the discharge side of the lightning arrester would remain connected to the non-grounded secondary of the transformer, which is, of course, undesirable.

Another member answers that water pipes should be used by all

means, that ground rods are only a poor makeshift, but if water pipes cannot be used the ground rod may be of service to you with the people, and in the courts, in case an accident cannot be avoided. He also recommends separate ground wires for lightning arresters and transformers. Bare wire could be used, but where it is run on the side of a pole it is better to use insulated wire for the sake of the linemen on 2200 volt lines. If wire of sufficient size is used there will not be much trouble from breaking, even if solid wire is used.

Inquiry Re Transformer Protection from Lightning

The member asks how far it is possible to protect transformers from the effects of lightning. He wonders if it is possible or advisable from a commercial and financial viewpoint to protect power transformers. He asks if transformers are really protected when lightning arresters are scattered about the primary circuits, but not directly connected to the leads of transformers. He would like to know how many arresters should be used for a bank of transformers or a single lighting transformer, also what type of arrester appears to have given the least trouble as regards grounding of circuits, after a lightning disturbance, causing damage.

Replies

A member replies that manufacturers now get out a type of arrester so low priced that protection for each transformer may be had without excessive expense. It is a question as between the cost of losing transformers by lightning and the cost of arresters, taking account, however, of interruptions to service, which must not be allowed where they can be avoided. It seems hardly necessary to provide 100 per cent. protection. Ample protection has been procured by installing arresters at critical points on primary circuits. In a Canadian city 100 per cent. protection was tried and afterwards discarded in favor of 30 per cent. protection,—this being deemed better, everything considered. For an outdoor arrester on primary circuits this member has found the Multigap type Garton-Daniels the most effective. The arrester is also equipped with a fuse. This enables it to turn off normal discharges but clears the line in case of heavy currents following. There is no protection from a direct hit of lightning.

Another member states that it would appear that the interest and depreciation on the capital expenditure necessary for the protection of 2200 volt transformers exceeds the monetary value of any possible protection which may be obtained on transformers, at least up to 20 K.V.A. size. For smaller sizes the suggestion is made that the manufacturers should take extra precaution in insulating against damage by lightning. It is suggested that a paper presented by Mr. Roper last year be read for more information on this subject. For a bank of power transformers three lightning arresters should be used. This

member knows of instances where both primary leads of a lighting transformer were burnt completely off inside the case during a lightning storm. During the last three years this member reports practically no trouble on 2200 volt arresters, mainly Garton-Daniels and C.G.E. Expulsion type.

Another member puts the matter this way. The amount that may be spent in providing protection for lighting transformers should be such as you would be willing to pay as premium for insurance against damage by lightning. The protection is usually only partial, however, as transformers are destroyed notwithstanding protection. One arrester per phase should be enough for a bank of transformers. This member prefers the Garton-Daniels arrester.

Inquiry Re Pole Steps

This member wishes to know if it is considered desirable to spike poles carrying 2200 volt wires, arc light circuits and secondary circuits in city streets, or should only those poles carrying transformers be spiked? Should a transmission line carrying a voltage of 10,000 and up, running through town and country districts, have poles spiked? Should steel poles have steps provided in both city and country districts. In the case of poles built up with lacing, should some means be provided at the base to prevent children climbing these poles.

Replies

One member states that it is obvious that only such poles as need to be climbed frequently should be spiked, such as lamp poles, transformer poles, etc. It has also been his practice to omit spikes on lines of 10,000 volts or over. In case of low voltage wires, transformers, etc., placed on the same poles, spikes should be provided as high as necessary to reach the low voltage parts, but omitted in the space between these parts and the high voltage wires. This member does not place steps on his steel poles, climbing being done by means of a ladder, or by using the lattice work in a pole of that kind.

This member thinks that from the standpoint of long life of poles they should be spiked where there is necessity for frequently climbing, but he assumes that the question is asked rather from the standpoint of safety and he also assumes that when spiking is spoken of it means that within a certain distance from the ground temporary steps or other devices are used so as to avoid spikes within reach of a man on the ground. This rule applies to all poles needing spiking, but where poles are made up of lacing, not on a protected right-of-way, and therefore accessible to children who might climb them, some obstruction should be placed for some distance above the ground, something that will not interfere with traffic on the thoroughfare. This member uses turned down hooks on the poles.

Another member with long experience believes that in the city

all poles should be spiked. They all have to be climbed, some very frequently, but he wishes to avoid the use of spurs which are not very safe for the linemen, and quickly damage the poles, making their appearance, which is never very good, much worse. The spikes should not be carried lower than 10 feet from the ground. Naturally, lattice poles in exposed places should have some protection against climbing by irresponsible or reckless persons. This member knows of a case where a grown up man climbed a lattice pole, caught the wire on top and was instantly killed, doing this on a dare, although there was a sign on the pole which he could not help reading, marked "Danger," together with the voltage.

Inquiry Re Concrete Reinforcing on Wood Poles

This member wishes to know whether the practice sometimes recommended to reinforce and prolong the life of wooden poles by placing reinforced concrete around the base, where decay first takes place, is advisable; whether the extra life obtained warrants the cost, and if the increased size of the butts is not objectionable on city streets.

Reply

This question was answered by one member who merely states that they have found the move practicable and would recommend it. No one else had any experience in the matter. It is one that might be discussed at this meeting with advantage if there is anyone present who can tell us about it from experience.

Inquiry Re Location of Stores Department

A member asks whether it is advisable to have a central store for all supplies used by a company, or to have different sources of supply in different parts of the city.

Replies

The answers stated, naturally, that it is a matter of the size of the city. It is quite certain that for most Canadian companies one general store is the proper thing, but that in a very large city it might save time to have certain supplies located in different districts in sub-stores, all subject, of course, to the general storekeeper.

Inquiry Re Line Construction by Contract

We are asked if there would be any advantage in a city where several companies use overhead lines in arranging with a general contractor who would do the line work for all the companies, installing and removing transformers and services with the idea of reducing the cost to each company.

Reply

The answers state that where the companies are very small so that a proper organization may not be maintained there might be

some advantage in the suggested plan, although there would be little disposition to co-operate if the companies were competing in business. No other answer has been made to this. It would seem to be largely a matter of local conditions which each company must decide for itself.

Inquiry Re Lightning Protection for Outdoor Stations

It is asked what is the best scheme for lightning protection and fusing for high tension outdoor stations.

Replies

One member suggests horn lightning arresters with a resistance placed in oil between the ground side of the horn and the ground. This has been found to work out satisfactorily on 13,000 volt lines. Another member has adopted a fused horn gap in series with the apparatus and a choke coil, but no lightning arresters, his idea being that for such stations the added complication of lightning protection with little or no attendance introduces a greater hazard than the omission of all protective apparatus other than that mentioned. He has had no trouble in four years where the above plan has been followed.

Inquiry Re Sealing Compound for Cable Potheads

The member is anxous to know if there is a really suitable sealing compound for heavy duty high tension outdoor cable potheads.

Reply

To this, answer is made by a member that his experience with outdoor potheads has been very unsatisfactory as regards the keeping out of moisture, and he has resorted to the ordinary taped head for all outdoor cable terminals. Break-downs on these have been few and can be attributed to the fact that the leads from the cable-head box have been brought up in such a way that water could enter inside the cable-head box.

Inquiry Re Use of Air Break Switches

The advisability of using airbreak switches and the proper construction of such was suggested for consideration, presumably for use where oil switches are now used.

Reply

This brought one answer from a member who says he tried one such switch, operated it twice then had to discard it on account of surges on the system.

Inquiry Re Fuse Protection

A member asked what is the best fuse protection for industrial service transformers of 75 to 200 K.W.

Reply

The answer to this is that the best protection is a fuse submerged in oil.

Inquiry Re Pole Preservative

A member asks: is pole preservation used, and how.

Replies

One member replies that if real good cedar can be had no preservative need be used. For lumber of poorer quality he recommends applying preservatives to the butt with a brush, while the pole is very dry. Another member states that pole preservation is not only practicable, but advisable. There are many workable schemes. The butts at least should be treated either by brush or impregnation. Companies selling these preservatives will furnish data as to the cost and effect of these treatments.

Inquiry Re Training Unskilled Labor

The question is raised owing to the shortage of trained men and companies having in consequence to use lower grades of men, whether some systematic system of training them should not be established. The inquirer finds it very difficult to impart even the necessary theoretical information. He cannot find any publications which seem to be plain enough for the average mechanic, and he wonders if it is possible to make simple line calculations so plain to the average line foreman that he may be able to check up for himself and not be entirely dependent on the Engineer or Superintendent.

Reply

The answer to this is that the present condition is temporary only, and it would not be advisable to spend a great deal in establishing educational means, that it is difficult to get men to read books and that practical talks to the men with illustrations on the blackboard, inviting questions and using great patience in answering, are means that might be used.

All the replies given above were furnished by members of this Committee and must be taken as their recommendations.

This is all we have to submit, and I trust it may be of some service.

The President: Contrary to the program, I think it would be well to proceed with the discussion of this paper, if anybody has any discussion to offer.

Mr. Peel (Cornwall): In speaking of lightning arresters, where you have a submarine cable crossing a small stream or river, connecting two overhead lines at each end, is it possible to install lightning arresters at each end of the cable?

The President: I will ask Mr. Dion to take a note of these questions and answer them altogether.

Mr. H. E. Randall: This is not exactly a question, but I think there are one or two things that might be quite properly brought up at this meeting, because I guess everyone of us are beginning to see red on some balance sheets. I think that if we go over our systems we will find that extensions or increases of capacity can be more cheaply obtained by a change of system than by a continuation of the present system. I dare say that a large number of us are still using two-wire secondaries for 110 volt distribution. Now, you can get four times the capacity by the installation of neutral wire that you can get with the two-wire circuit of the same size for the same distance. Now, that means for electric stove installations, for example, or long secondary runs that you can get much better secondary regulation with less cost, which is a feature to-day.

Another thing that might be mentioned is that a large number of us are not yet using 4-wire, 3-phase primary transmission systems operating at 4000 volts rather than 2200.

The addition of the neutral wire to our present 2200 volt systems for 4000 volt operation triples their capacity, so that when our industrial loads for munition plants come on, which would normally require a new feeder system, sometimes with little thought, the addition of one wire will give us the required capacity. This does not necessarily mean either the installation of transformers or wire except the neutral wire, because with the neutral wire you still have the possibility of the open delta connection to be used for small loads.

Another feature is, that most of us on straight series circuits in smaller towns, if we have them, have been using No. 6 copper wire, for the simple reason that nothing smaller than that was strong enough to stand up—what is the objection to using No. 6 B.W.G. iron? With the present day prices of copper wire, No. 6 iron wire offers rather an interesting half an hour's thought. It works; we know it does.

Mr. J. S. Gould: Something was said in the paper about preservatives on poles. I don't know much about it, but I just want to remark that yesterday morning I passed a place where a gang of men were moving a cedar pole, 40 feet high, which I had placed there 25 years ago this fall. The pole was lifted out of the ground just as I passed. I was interested to know how it had endured all these years in the ground. There was a pick lying on the sidewalk which they had been using, right beside the body of the pole. I lifted up the pick and drove it into the body of the pole, which had been in the ground for a quarter of a century, and, gentlemen, I came immediately to the conclusion that preservatives were useless. The pole was evidently good for twenty-five years more.

The President: Regarding that remark, I would like to know whether the pole had had preservatives or whether it had not. You can take it either way.

Mr. Davies: 25 years ago—don't know. Then in this valuable contribution there was a question brought up of using a common ground wire for transformers and lightning arresters, and I can unqualifiedly state that it is a mistake. I have had experience; I know where three houses were burned to the ground, through the primary getting back up the ground wire into the secondary system and setting fire to the house. This was in a system where the only ground on the transformers was on the secondary side of the pole. Of course, in Ontario I understand you have grounds in the houses, and I might say the company I am with at the present time insist on every house installation being grounded, which might give better protection. However, I would always advise against a common ground wire for lightning arresters and transformer secondaries.

In connection with the use of lightning protection on transformers, Mr. Roper's paper presented, I think, in Chicago in 1916, was a very careful study of that, and the question boils down to service. If you consider your service to your customers most valuable and you wish to keep a good name, why it pays you to go to the limit for transformer protection.

I noticed that there was an opinion given by someone to the effect that lightning arresters placed at exposed points on primary lines were just as good as protection of individual transformers. I don't know where the information was gotten, but Mr. Roper made a definite statement, which has also been borne out by the experience I have had, that the indiscriminate placing of lightning arresters is useless and of absolutely no value at all. Individual transformer protection, on the other hand, is not useless, and you can get practically 90 per cent. protection if you put lightning arresters right at the transformer.

The second point in connection with that question is the extra insulation of the end primary turns, at least I presume the leads coming out of small transformers, as being a good protection. That is very doubtful. Last year the Montreal Light, Heat and Power Consolidated lost 170 transformers in the case of two electrical storms. Those 170 trannsformers came right off the line as burned up. Now, of those 170 transformers, there were 90 ready to put back in service within a day, their only trouble being broken down primary leads just inside the case. The bunch that did not break down on the end connections, which were extra well insulated, were destroyed, so a weak spot where easily accessible is not much of a menace after all.

Mr. Dion also spoke about signs on poles, and mentioned the fact that some man climbed up a pole where a sign stared him in the face warning not to do it. That brings up the question as to whether

it is advisable to put signs on poles or whether it is not. There are always going to be some poles you will miss putting signs on, and if someone is killed on such a pole, well, you did not put a sign on. It is a very open question whether signs on poles are advisable or whether they are not.

I want to compliment Mr. Dion on the paper which he got together. I think that he brought up some very good questions though old ones. It does you good to go over these things once in a while.

The President: Any further discussion?

Mr. Maclachlan: There is one point in connection with lightning arrester ground wires, and the grounding of the primary line. I think it would be very well for any Company that is going into it to also consider the mechanical protection of the ground wire down the poles. There have been a number of serious accidents to children playing with the ground wire, getting voltage off it, close to the ground. Some horses have been killed by the same thing, and I have been recommending where I can the protection of the ground wire by a wooden strip, that will stand a spur, right up the ground wire to the transformer or up to the primary line. The New York Edison in the Bronx use fibre conduit entirely in covering larger ground wires.

Now, one question in line work that I think will have to be brought up sooner or later, and that is the use of weatherproof covering of wires. Personally, from an accident prevention standpoint, I think it is a great hazard. I think the time will come when we will use bare wires for primaries at least. We may not come to it for secondaries, but I think the time is coming when we will use bare wire primaries. No engineer will go into the witness box and say that the ordinary insulation is any material advantage in preventing accidents on poles, and when the line man sees a wire covered with this weatherproof covering, he considers that it is insulated, and he will go ahead and do work on them that he would not consider doing for one moment if it is bare wire. There have been systems operating in Ontario with bare primaries for some years without any great trouble through grounding of the line.

Mr. Anderson, Three Rivers: In Mr. Dion's paper mention was made of ladders instead of steps on the iron poles. I might mention that our company in putting up our steel poles bored holes in them and had a special climber that the men would put on and they would use these holes and get up on the pole with that.

Then in reference to spikes on poles, it seems to me that these spikes lead to a lot of trouble. We put them on, say, ten feet from the ground. Well, we come along and find they are only eight feet from the ground, and in the winter time there comes five feet of snow and that makes the spike very dangerous to catch your eye in as you go by, and I do not see why we could not do without pole steps altogether, except perhaps in very special poles.

I was very much interested in the discussion on ground wires. You see so many of the ground wires coming down the pole just left loose, so that a horse and rig coming along might break it off, and this is a great source of danger.

Mr. E. A. Dunlop, Pembroke: I would like to ask if there is any advantage in placing home-made choke coils on the wire between lightning arrester and apparatus to be protected? We have a customer who had a 140 h.p. motor burned out last summer protected by the usual lightning arresters. I suggested that he make a home-made choke coil, and this Spring, the very first lightning storm we had the same motor was burned out again. Is such a home-made choke coil effective?

Another question I would like to ask is, how near a 25,000 volt line is it safe for firemen to play water? We had a fire in our town the other day and we could not get the firemen to go within a block of the wire, and as a result we had a couple of poles burned out. I understood that 10 to 15 feet away was quite safe. Is there any member here who has any experience as to how near a 25,000 volt line it would be safe to play a stream of water?

Mr. Davies: I think a man could play an ordinary stream of water on a 25,000 volt line standing twenty feet away from it without any danger.

Mr. Maclachlan: Out in the West, under test, straight streams of water were played on 60,000 volts. If the direct stream of water is not on the line, I think you can go up to 110,000 volts, and as long as there is only a spray on it there is absolutely no danger.

The President: I will ask Mr. Dion to close the discussion by answering the gentleman from Brockville.

Mr. A. A. Dion: The question was asked, where a submarine cable crosses a small river or stream, connecting two overhead lines at each end, whether it should be protected by lightning arresters. I say by all means protect it at each end by lightning arresters and good grounds.

The question of poles has been raised, the use of preservatives on same. I might say I would confirm what has been said about the long life of cedar poles. It is extremely long, the kind of cedar we get in this country. It depends, of course, on the soil to a considerable extent. There are some soils where you would naturally need protection, but with dry soils, ordinary clay or sand or mixed soils the cedar poles have an extremely long life, in this city exceeding 25 years a good deal in some cases. Some years ago a company was formed in this city and they were building lines in a hurry and they could not procure good cedar poles. As you know, it is more difficult to get straight cedar poles than other kinds of timber, and they used spruce poles, which were reputed to have a life of seven years. I had nothing to do with that company but I thought it was a great

mistake. The life of these poles has been very surprising; in many cases it is double what was expected of them.

In regard to bare ground wires on the side of poles, they should by all means be protected by a strip of wood, preferably hardwood, or fibre conduit.

Mr. Dunlop raised the question of the choke coil. No doubt the choke coil is a good thing. I do not say it would protect in every case, but possibly if he had had a few more twists on it would have saved his motor.

Mr. Grier: I am going to be guilty of a great mistake, because I think they say gratuitous advice is always absolutely valueless. I should be, in a sense, qualified to speak of that matter of putting signs on posts. I quite admit the difficulty in which the speaker is who raised the question first, but I may say quite frankly that, speaking as one who occasionally has to consider the question of how easily or how difficult a litigant will prove his case, speaking from that standpoint I would be very much pleased if I am informed by those who have to do with the operation of the company that the post has the danger sign on, than to hear from them they have not. May I make the point a little more clear: If there was a universally uniform practice of having no signs up, then it might, perhaps, be safe in the case of a particular company to have none, but as it is the case that they are very largely used, I doubt very much if any company would find itself free from criticism if in a particular case it had no sign. I quite admit the suggestion, that exercise the care you will, there are or may be some individual posts that have not the sign, but I would give the counsel the protection, if it is possible that the signs be put up, because no matter how unfair or unreasonable or fair or reasonable the claim of the plaintiff may be, you at least are able to say you have gone to the extreme care on his behalf by indicating in language that there is danger. That is my opinion, given free. (Applause).

The President: The Chairman is going to take the liberty of introducing an innovation in connection with our usual procedure, and following somewhat the lines of the National Electric Light Association where the President makes a very formal and exhaustive address. It has become the practice for some years and it is customary, as the views stated are the President's own views and may not carry conviction with the Convention or Association, that his report be referred to a Committee who will bring in a resolution later on in the convention proceedings as to whether or not the report is accepted and adopted as the view of the Association. I, therefore, will take the liberty to nominate a Committee on the President's address, who will report later, and will nominate on that Committee Mr. Grier, Mr. Dion and Mr. Dunlop. If they will kindly take the

address and see whether they can recommend the convention to accept it.

Further than that, it is usual to nominate a Nominating Committee for the officers for the ensuing year to bring in a report at Class A meeting, which will be held after the Session this afternoon. This Nominating Committee, as you know, merely names the slate, and that slate is subject to amendment by open nominations at the Class A members' meeting. On that Committee I will nominate Mr. Dion as Chairman, Mr. Davies, Mr. Doddridge, Mr. Randall and Mr. Gould. I will ask those gentlemen to meet before the Class A members' meeting and bring in the slate for the officers for the ensuing year.

Mr. J. F. Neild, Chairman of the Committee on Electrical Apparatus Report is unable to be here with us as he is very busily engaged as registrar under the man power registration, and I will now ask Mr. Volkman, of the Toronto Electric Light Company, if he will kindly read Mr. Neild's Report.

Report of Committee on Electrical Apparatus

J. F. Neild, Chairman

Your committee herewith submit the following notes on the progress in the development of electrical apparatus.

The past year has been one of high pressure in business, the insistant demand for electrical machinery, particularly motors of all kinds, has forced the intensive production of standard types, and this has no doubt in many ways re-acted in delaying the normal advancement of the development of electrical apparatus.

There has been a wide expansion of the application of electrical processes in the metallurgic and chemical industries, causing many problems to arise in heat control, speed control, protection, etc., and these should prove a very fruitful field for an interesting report in the future.

The development of remote control, self control and automatic synchronizing and paralleling devices and the ruggedness of machines, has made possible the automatic sub-station. The fact that motor generators and rotaries are now left to run virtually unattended, speaks eloquently for the progress in machine design, and in these days of labor shortage and the necessity for economy the automatic sub-station should receive the widest possible attention.

In alternating current generators, no radical changes appear, but the mechanical improvements permit of higher speeds in larger units. A horizontal water wheel generator rated at 20,000 kv.a., 6600 volts, 60 cycle, and operated at 360 r.p.m., represents the limit of this class as attained at present, while in the slow speed machines, a 10,000 kv.a., 6600 volt vertical water wheel generator, 60 cycle, has been built at 55.6 r.p.m.

In alternating current motors, the speed control question is developing, and now motors of 2200 h.p. are made with a speed range of 430/300. With auxiliary speed control apparatus, the synchronous speed disappears, and control can be maintained in most cases without sacrificing torque.

In heavy duty motors for mill work, progress is being made, especially in the reversing drive type, and installation has been made of a 22,000 h.p. unit. This is a double unit consisting of two motors electrically in series on a common base. The current is supplied by a flywheel type motor generator consisting of three units electrically in series.

In the question of transformers, the principal improvement lies along the lines of better insulation distribution, and greater ability to resist the mechanical forces imposed by short circuits. These results are obtained by using circular coil construction.

The development of single phase self-cooled transformers up to 8,000 kv.a. has resulted in a type of cooling apparatus using external radiators combined with the standard corrugated case. Oil conservator tanks are also used. In this arrangement the transformer cases are air tight, and are completely filled with oil, the expansion being taken care of in the external conservation tank usually placed on top of the case.

In direct current motors, the principal advance has been in speed control, being obtained by an auxiliary winding embedded in the main pole pieces, additional to the commutating poles. This compensating winding practically prevents flux distortion losses, permitting rapid acceleration from low to high speed.

The question of service, particularly on high tension power lines, is demanding effectual relay application and to-day important feeders are no longer affected by troubles being allowed to spread.

These results are largely brought about by the application of balanced currents with instantaneous overload relays of the single plunger type or with relays of the induction type.

The single plunger relay is now a more rugged piece of apparatus, and is proving capable of the heavy duty at times imposed on it.

The great advantage of the induction type relay, is the accuracy, and permanence of the calibration.

Your committee wish to express their appreciation to those who have assisted them.

Respectfully submitted,

J. F. Neild, Chairman,
Committee on Electrical Appraratus

The President: I regret very much that the chairman is not here. He has taken some trouble with this paper. If there are any questions or discussion we would like to have it, and possibly we

can secure some adequate reply from the galaxy of talent we have here.

Mr. Randall: Mr. President, there seems to be a tendency to use three phase distribution transformers for power service. I would be glad to learn how far that has gone among the member companies. That is, in sizes of 5, 10 and 20 kw., 2200 volts.

Mr. Volkman: I might state in the Toronto Electric Light Company practically all of their industrial work is taken care of by 100, 250, and 500 kv.a., units.

Mr. Randall: Supplying secondary mains?

Mr. Volkman: Yes. There are no cases to my knowledge on our system where smaller units have been used for that work.

Mr. Davies: Speaking for the Montreal Consolidated, we started building three phase units for small services about two years ago. The benefit of three single phase transformers is, if one transformer burns out a trouble man can soon restore service. Small three phase transformers (5 kw. will take care of 5 h.p.) are very good indeed. There have been no burn-outs on the transformers used so far—about 18 of them—of course that speaks for itself. Again, they are very much cheaper to build. You can build a 5 kw. transformer for about one-half the cost of three single phase transformers of the same capacity. Unfortunately the manufacturers of transformers do not encourage them as they are special and they don't want to build them.

The President: Do you feel called upon to make any defence for the manufacturers?

Mr. Rough: As a transformer manufacturer, we are willing to give people what they want. If they want three phase transformers we will be very glad to build them.

Mr. T. C. Martin: As a matter of information, and also in the shape of a query, it may be interesting to the members to know that practically all the generating apparatus now under manufacture in the United States of and above 500 kw. has been commandeered. The War Industry Board has taken the matter under advisement, and in co-operation with our Committee at Washington has a complete list of all such apparatus, and although it may be under order and under contract, no single piece of that character is allowed to be delivered to anybody on any terms unless it is absolutely needed for the supply of current primarily in connection with the war. A great many of our companies are very much over sold and a number sorely in need of new generating capacity, but they do not get it unless it goes toward the great cause. I do not know whether any such condition applies in Canada at the present time. I have not heard of any, and I would like to take that information back with me, if any such rule is in effect or contemplated in the near future?

Mr. Volkman: As far as I know, from the Canadian manufacturers' standpoint there has been no requirements for anything of

that kind here. There has been plenty of equipment to fill all needs, although I believe there are further embargoes to be placed on materials, and there may be something of that kind.

Mr. A. A. Dion: I have been under the impression that there was no shortage of generating capacity. The fact that most of the plants which have been called upon for extra service on account of the war were short of power, and that was the limiting factor and not the generating capacity.

Mr. T. C. Martin: In one instance where there is a great shortage, and generating capacity can be sent from a point where it is lying inert to a point where it will immediately go into service—take Hog Island as an example, I believe that system is the largest in the world supplying electrical energy for war purposes, and it has put our Philadelphia friends very much on the rack to take care of the conditions that they are up against. So that they do not feel they are doing an unkindly act to any other person if they put a string on a 25,000 kw. generator, which happens to be coming along, through the War Industry Board to get it.

The President: We have had a very interesting morning, and unless there is some further discussion on this admirable paper on Electrical Apparatus, I think we will adjourn for luncheon. I want to impress upon you that we have some very interesting and important papers this afternoon and ask you to try and be prompt in returning to this room at about 2 o'clock, for we would like to go through our program in time to have a little respite before dinner. These papers will take some time, and there is sure to be a good deal of discussion. I declare the meeting adjourned for luncheon.

——On resuming at 2 p.m.

The President: We will start the afternoon session by calling on Mr. Volkman to read the Meter Committee Report. I hope there will be an animated discussion on this.

Report of Committee on Meters

Wm. Volkman, Chairman

To the President and Members of the
Canadian Electrical Association.

Gentlemen:—

Your Committee on Meters, in line with recommendations made at the last Convention, submit the following for your consideration.

Owing to the great and pressing needs brought about by the war there has been little time available for the manufacturers of meters to devote to new developments, so that in going over the field we find very little change during the past year.

Watthour Meters

The General Electric Company standardized their I-14 watthour meter for general use about three years ago. This meter is still

standard with them and no changes have been made in the design.

The Canadian Westinghouse Company have developed a new single phase watthour meter known as the Type CC, which now supercedes the Type C in sizes from 5 to 20 amperes, two wire.

In designing this meter, simplicity of construction, calibration and manufacture have been given great attention, all parts are made on an interchangeable basis, and the assembly of parts is checked by gauges, so that very little variation is found in the product. All wearing and calibrating parts are readily accessible, so that the cost of repairing and checking are reduced to a minimum.

The tests on this meter show a performance considerably better than the Type C. The 60 cycle meter load curves show a variation of .2 per cent. from no load to 75 per cent. overload, and a drop of .8 per cent. from 75 per cent. to 100 per cent. overload; the performance of the 25 cycle meter, while not as good as the 60 cycle, is much better than the type C. The load curves vary about .3 per cent. from N.L. to full load with a drop to 1 per cent, at 50 per cent. O.L. and 2.2 per cent. at 100 per cent. O.L. There is little change in the accuracy for voltage variations 10 per cent. above and below normal.

The Sangamo Company have made no changes in their type H. meter which has been their standard for the last two years. It might be of special interest, however, to note that the Sangamo Company are now assembling all of their meters and manufacturing 90 per cent. of the parts in Canada.

The Packard Company have made changes in the design of their Type K. induction meter which overcomes the previous difficulties encountered in their product.

There have been no changes in the line of D.C. watthour meters during the past year which have come to the attention of your committee.

Graphic Wattmeters

The Westinghouse and General Electric Companies have made no changes in their line of Graphic meters during the past year.

The Esterline Company have made some changes in design on their type E. B. meter which will considerably increase the usefulness of this meter. We understand, however, that these improved meters are not as yet in production so that it will probably be three or four months before they become available to the trade.

The Bristol Company have developed a line of Graphic strip recording meters for A.C. and D.C. of the dynamometer type. The electrical design has been given very close attention so that these meters should prove very acceptable to the trade. The clock mechanism is very substantial and is arranged for a normal speed per hour and a special speed by moving a lever of the same speed per minute.

Indicating Meters

Switchboard Type. There has been very little change in the general lines of switchboard meters during the past year. The principal changes being entirely along the lines of smaller meters so as to decrease the amount of switchboard space required. All companies manufacturing these lines now have a line of small meters.

The General Electric Company have placed on the market a miniature round pattern A.C. ammeter approximately 3 inches in diameter similar in appearance to their direct current instrument type D.M. This instrument has a rolled bakelite and drawn brass cover with full glass dial.

A new line of 'fan shaped" instruments has been placed on the market by the Weston Electrical Instrument Company. These instruments are of the permanent magnet type and are D.C. voltmeters and ammeters for switchboard mounting. There are four sizes, known as models 267, 269, 271 and 273. The principal dimensions of model 267—4-5/64 in. wide x 3-3/8 in. high x 1-3/32 in. deep. Scale length 2.5 in., and the large instruments, model 273, dimensions are 9-5/16 in. x 7-31/32 in. x 2-1/16 in., scale length 7.6 in. These instruments have remarkably long open and legible scales, the longest scale ever attained in instruments of their size. The scale arc is 120 degs. as against about 86 degs for the round pattern Weston meters of similar principle. The shunt drop of the ammeters is 50 M.V. and the voltmeters have a sensitivity of about 100 ohms per volt. Each model has a wide list of standard ranges, for instance, model 267 voltmeter being listed in 38 ranges from 50 M.V. to 150 volts, and the ammeter ranges run from 1 amp. to 150 amps. in 21 capacities all self-contained to 30 amps.

Laboratory Instruments

A laboratory standard line of Voltmeter, Ammeter and single phase wattmeter known as the Model 326, has been developed by the Weston Electrical Instrument Company. These instruments are of the dynamometer type and are for A.C. and D.C. service. These instruments are conservatively guaranteed to be within 1/10 of one per cent. on direct current or on alternating current up to 133 cycles, or if specially ordered up to 600 cycles. They are compensated for temperature, are air damped and shielded from external magnetic and electrostatic influences. The scales are provided with mirrors and are sub-divided into fifths by means of diagonal lines intersecting with six concentric arcs. The length of the scale is approximately twelve inches. The instruments are provided with zero correctors, spirit levels and adjustable levelling screws. The wattmeter is entirely compensated for phase angle errors and the current circuit is designed for 100 per cent. continuous overload.

Demand Meters

The determining of customers' maximum demands is probably one of the greatest problems of the meter engineers at the present time. For large customers this is not as great a problem as for the small customers, for in the former case the Power Company is justified on account of the greater revenue in installing the more expensive meters now necessary to determine the maximum demand, but for small loads this method cannot be considered.

There are on the market at the present time quite a number of definite time maximum demand meters, manufactured by the different companies, but practically all of these meters are open to the objection that if a customers maximum demand does not occur in synchronism with one of the definite time periods, the actual maximum demand would not be recorded. The problem of obtaining a customer's maximum demand by the definite time demand meters depends, of course, upon the type of load being supplied, in other words, the nearer a customer operates to 100 per cent. load factor, the more accurate this method becomes, similarly, if a customer's maximum demand occurs only once or twice during a month, and this maximum demand is considerably above his average load, the operating company is liable to lose as high as 50 per cent. of its revenue.

From a meter or engineering standpoint the ideal is to be able to obtain the absolutely correct maximum demand at whatever time it occurs. However, since the present range of meters are not always practicable for this purpose, compromises are necessary between the rate charged for power and the method of determining the amount of power used so as to insure the requisite return to the power company for services supplied.

Probably the latest development in the line of maximum demand meters is the Westinghouse Type R. H. meter, which is built on an entirely new principle. This meter is operated on a thermal and heat storage basis. A coiled thermostat, the temperature of which is directly controlled by the amount of k.v.a. in the circuit, is enclosed in a metalic case. This case is made light or heavy, depending upon the length of demand period desired. Upon any change in load the temperature of the element begins to change and continues to do so until the rate of heat loss is balanced by the rate at which energy is being supplied. The change in temperature takes place according to a logarithmic law, and it is in this respect that the meter gives an entirely different type of maximum demand from that given by the straight line electro-magnetic meters. The meter is designed on a 15 and 30 minute basis.

The principal feature claimed for this meter is the fact that it takes into account the heating of generating equipment as it follows the same general laws. However, while this is true the adoption of

the meter would mean an entire rearrangement of rates and contracts in order to insure the operating company the necessary income.

Power Factor Determination.

One of the greatest problems which the operating companies have to face at the present time, owing to high costs of material and long deliveries, is the question of getting out of their available equipment 100 per cent. value. Wherever a.c. power is used for power purposes the capacity of lines and apparatus must be greater than would actually be necessary if we did not have to provide for the wattless energy of customer's apparatus.

At this time, when central stations are confronted with the problem of handling an ever increasing load over existing lines, and are confronted with extremely high cost for additions to line capacity, the relief which can be obtained by the bettering of power factor of customer's loads is of prime importance.

Those companies who have in the past not paid particular attention to the power factor of their customer's loads, and have made no provision for a reasonable power factor, or have made such provision, and have not enforced it, have found, upon investigation, that in general the power factor of these consumers' loads is extremely low, and instances of 60 per cent. and less are by no means rare.

If the power factor of the consumers' loads was increased to some reasonable figure, say 85 per cent. to 90 per cent., the carrying capacity of secondary lines for the same voltage drop would be more than double, and a corresponding saving in power loss would result.

In the past there seems to have been no standard clause covering the regulation of power factor in power contracts, but one of the larger power companies has the following clause, which would seem to adequately cover the entire correction of power factor, either for power sold on a maximum demand basis, on a kilowatt hour basis, or on a mixed rate, as follows:

> "If at any time, when the power is being delivered to the purchaser at normal voltage, and frequency, the total volt amperes so delivered exceeds that which would result if the power which the purchaser is then taking hereunder were delivered at a power factor of 85 per cent,. the volt amperes delivered shall be calculated as power upon the basis of 85 per cent. power factor."

and in this regard, it should be noted that the determination of power factor, which is to be used as a basis for penalty, requires a materially different method of determination when applied to maximum demand power, or when applied to kilowatt hour energy consumption.

Some companies have adopted the practice of writing into their contracts the statement that k.v.a. for billing purposes is to be taken

as the k.w., this is applicable to both the maximum demand method, or kilowatt hour method. This method, of course, is only applicable to special contracts where the rate can be readily changed (i.e.) it would not be entirely fair where definite power rates are established for an entire community unless all contracts are written to contain the clause.

It would, therefore, seem of importance to outline the means and methods available for the determination of the power factor of the consumers' loads; in order to properly apply the penalty in case of low power factor, which will sooner or later result in the bettering of the consumers' low power factor, and in the meantime will allow the power company a reasonable return on the line capacity used for the supply of power to low power factor loads, which could otherwise be employed for the supply of new consumers.

The meter to be desired for this purpose is one which will record volt amperes directly. Considerable time and money have been spent in an attempt to design a meter of this type, but as yet none have been produced. The Westinghouse type R. H. however, comes closer than any other since it is operated entirely on the thermal principle, which, of course, takes the wattless component as well as the watts.

Methods of Determining Power Factor.

1. The instrument first brought to mind to obtain some record of power factor, is some sort of power factor recorder or indicator. These instruments have, however, not been found satisfactory by several of the member companies, in that they require at least 60 per cent. of full load to be of sufficient accuracy to warrant their use, and also in that they are least accurate at low points of the scale, where most penalty power factors lie.

For these reasons, these instruments can be assumed as unsatisfactory for our purposes.

One of the member companies has gone so far as to abolish their use entirely, replacing them by a Graphic Watt Meter, connected to read the wattless component on consumers' loads, and even in power stations.

2. The simplest and most obvious method of determining average power factor is by the use of either two single phase meters, or one single phase meter in connection with a polyphase instrument, which gives the total energy consumption. This method is, of course, applicable in cases only where the consumer is charged on a straight kilowatt hour rate, or on a mixed rate basis.

This method assumes exact balance of load, and is not applicable to loads which are badly unbalanced. On large loads of induction motors, however, there is no objection to using it, as very closely balanced loads are the rule.

Assuming balanced load, then, in any three phase circuit, the reading of one single phase watthour meter will be:

$$W_1 = VI \text{ Cos } (\theta + 30°) \text{ and}$$
$$W_2 = VI \text{ Cos } (\theta - 30°)$$

will be the reading of the second single phase meter.

The sum of these two quantities may be shown to be the total power in the circuit, while the ratio of their sum and difference may be reduced to the following quantities:

$$\text{Tan } \theta = 1.732 \frac{W_1 - W_2}{W_1 + W_2}$$

therefore, the angle of lag may be found from which the cosine or power factor may be taken from any table of natural functions.

An easier method, perhaps, of determining power factor is to read off the value of power factor from a curve plotted between power

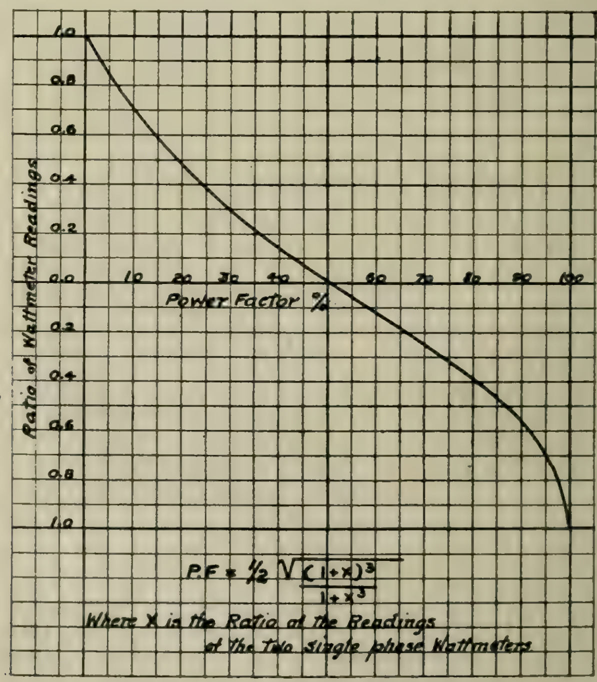


Figure 3
Power factor from ratio of single phase wattmeter readings. Wattmeters connected two meter method for measuring three phase power.

factor and ratio of watthour meter readings. One familiar form of this curve is shown in Fig. 3, the ratio being expressed as less than one, that is the ratio of the smaller to the larger reading.

In cases where single phase meters are employed, in connection with polyphase meters, the reading of the former is to be subtracted from the latter, the ratio being taken between the difference and the reading of the single phase meter, or vice versa, as the case may be. The average power factor is then determined from the curve, and the total consumption increased in the ratio of contract power factor to the actual value.

3. In cases of badly unbalanced loads, or in cases where power is sold on a maximum demand basis, the above method is not ap-

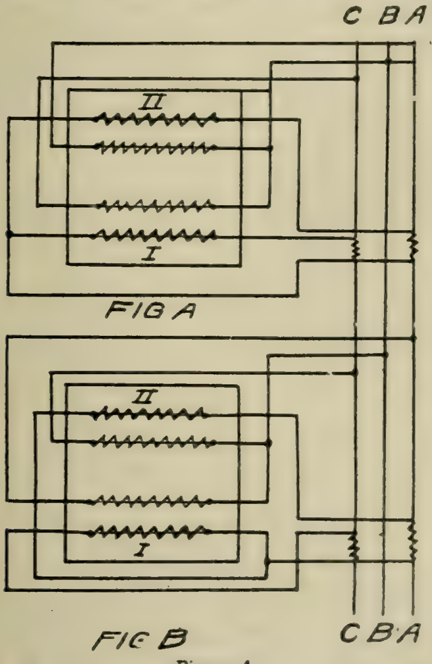


Figure 4
A—Standard Wattmeter connection for three phase circuit.
B—Standard Wattmeter connected in three phase circuit to read r.v.a.

plicable, and it becomes necessary to use equipment which will give the average power factor of an unbalanced load, or power factor at the time of peak.

One method available to determine average power factor under these conditions is by connecting a standard watthour meter or graphic watt meter to read proportional to the wattless component of the load. This method was partly described by H. S. Baker before the 1911 Convention of the Canadian Electrical Association. This equipment used in connection with ordinary apparatus giving true power or energy offers a means of obtaining power factor at peak.

In Fig. 4-A is shown the standard connection of a meter to read true power, or the energy component of the load. Fig. B shows the connection in which the indication is proportional to the wattless component, in which it is noted that the current in element 1 of the meter is reversed, while the potential of element 1 is taken from phase B C instead of B A; the current of element 2 is unchanged, but its potential is taken from phase B A instead of B C. It may be shown that with the meter connected in this manner, the indication is equal to 2 V I sin ϕ for balanced loads, and for unbalanced loads, it is still proportional to the wattless component. By multiplying this indication by 86.6 per cent. the true wattless component is obtained.

Therefore, from the corrected reading of this meter in connection with reading of true power, the angle of lag, and hence the power factor, may be determined by taking the ratio of 86.6 per cent. of the former to the latter reading, or again a curve may be constructed between ratio and power factor.

By using two graphic watt meters, one connected for true power, and one connected as above, and the clocks kept in synchronism continuous records of the wattless component, and hence power factor is obtained.

Instead of using the above factor of 86.6 per cent., there is no reason why the manufacturers of the various types of meters could not turn them out to read the wattless component directly, indeed one of the larger manufacturers has already done this for one of the member companies.

Considerable care should be exercised in connecting up this meter to obtain the correct indication. One method found to be successful is as follows:

Referring to Fig. 4-A.—If the potential lead of element 1 is connected to phase C instead of A the potential lead of element 2 is connected to phase A instead of C the middle wire being unchanged, while no changes are made to the current coils, if the meter was connected correctly at first, the indication under the revised connection will be zero. If it is not the current coils should be changed until a zero indication is obtained.

With the meter indicating zero, the current lead, which when reversed, will cause the meter to rotate or indicate in a positive direction, should be found. With this connection the meter is now indicating proportional to the wattless component.

4. A third method which is applicable to watthour meters and indicating watt meters, and which has been applied to an indicating watt meter by a German instrument company, consists essentially of overlagging the potential element of the meter, so that the angle between unity power factor current flux and the potential flux will be 90 plus an angle, say alpha instead of 90. This overlagging may be accomplished by inserting an external reactor in the potential circuit

of the meter, or by using the compensating coils of the commercial type of meter, should a sufficient amount be obtainable for cases met in practice.

Assuming a contract power factor of 85 per cent. as a basis to work upon, the ideal meter would be one which would indicate 85 per cent. of k.v.a. for all values of power factor. To approach this ideal condition, this method consists of artificially shifting the voltage coil current so that the indication will be a certain percentage of k.v.a. at

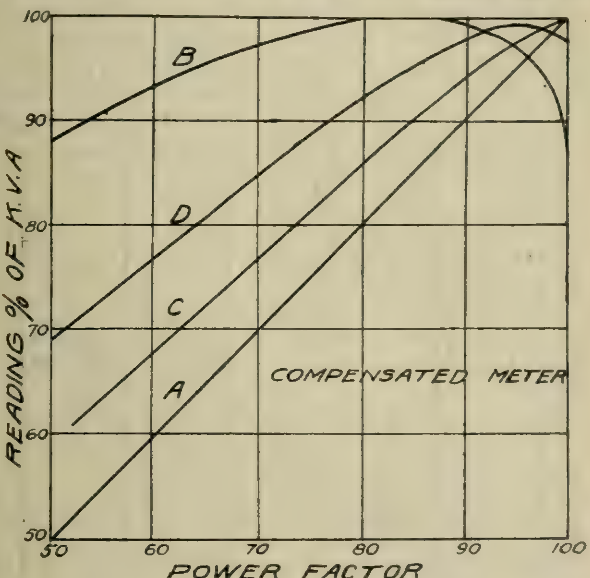


Figure 5

Wattmeters compensated to read predetermined percentage of K.V.A.
A—Curve for Accurate Meter.
B—Compensated to read 100% K.V.A. at 85% P.F.
C—Compensated to read 90% K.V.A. at 85% P.F.
D—Compensated to read 95% K.V.A. at 85% P.F.

85 per cent. power factor, and so that the registration will be as near 85 per cent. of k.v.a. as possible, at the actual operating power factor.

With the meter compensated to read a certain percentage of k.v.a. at 85 per cent. power factor, the voltage vector will be turned through some angle, say ϕ, to effect the desired compensation, then the readings of the two elements of the polyphase meter will be as follows:

$$W_1 = V\,I\ \mathrm{Cos}\ (30^\circ + (\theta - \phi))$$
$$W_2 = V\,I\ \mathrm{Cos}\ (30^\circ - (\theta - \phi))$$

To illustrate the equations four curves have been plotted as per Fig. 5, in which different degrees of compensation have been chosen, which are shown in the table below:

Curve	θ at 85% p.f.	Reading at 85% p.f.	Angle of Compensation
A	31° 48′	85% kv.a.	6°
B	31° 48′	100% kv.a.	31° 48′
C	31° 48′	90% kv.a.	6°
D	31° 48′	95% kv.a.	13° 36′

From a consideration of these curves it will be seen that with a 70 per cent. power factor load, and with a meter compensated to read 95 per cent. k.v.a. at 85 per cent. power factor, shown by curve C. Fig. 5, the consumer would be charged actually 85 per cent. of k.v.a., and for variations in power factor of 5 per cent. either way, the meter would register sufficiently accurate for all material purposes.

Upon examination of curve B, which is for a meter compensated to read 100 per cent. k.v.a. at 85 per cent. power factor, it is seen

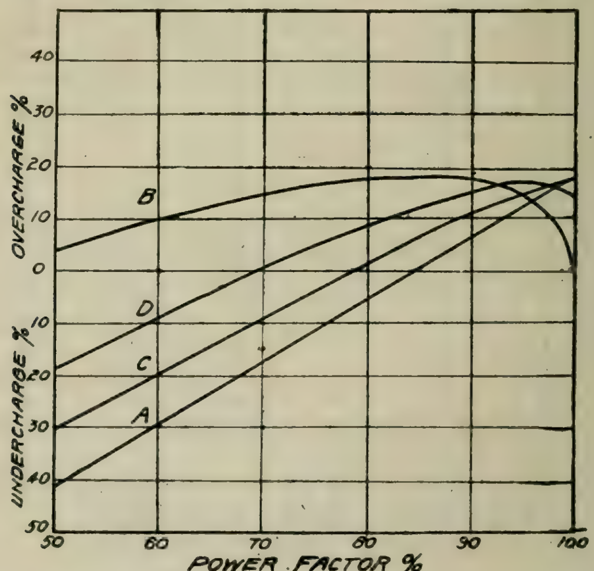


Figure 6
Curves showing overcharge and undercharge on compensated wattmeters.
A—Curve for Accurate Meter.
B—Compensated to read 100% K.V.A. at 85% P.F.
C—Compensated to read 90% K.V.A. at 85% P.F.
D—Compensated to read 95% K.V.A. at 85% P.F.

that the power factor may vary from 70 per cent. to 90 per cent. without a result in error greater than 3 per cent. in volt ampere measurement. Therefore, on consumers whose power factor falls between these limits, it would be possible to install a meter with this compensation taking 85 per cent. of the readings as amount to be charged for, assuming, of course, contract power factor to be of this value.

Fig. 6 shows curves similar to those of Fig. 5, but drawn to show

the rate of overcharge and undercharge at various power factors for the different compensations. It should be noted in connection with this type of meter that for leading power factor, there will be a deduction in registration, so that it should not be used unless a reduction in price per k.w.h. for energy taken at leading power factors is justifiable. Also an inherent drawback of the compensated meter, as well as of the ordinary meter, is that, as the power factor decreases the rate of undercharge decreases, a much less desirable arrangement than if the rate of undercharge decreased only when power factors of more than contract amount were obtained.

One example of additional revenue to the central station from the application of penalty due to low power factor may be cited. Power is sold to this consumer on a kilowatt hour basis and the load is a very closely balanced one, power factor being determined from ratio of readings of two single phase watthour meters.

Month.	Average	Return due to low P.F.
Jan.	82.6%	$109.68
Feb.	79.5%	260.16
Mar.	78.5%	282.03
Apr.	83.1%	91.54
May	78.5%	338.64

Summarizing, it may again be emphasized that the question of consumers' power factor is of vital importance to central stations in these days of increasing loads and costs, and all available means of bettering conditions should be rigorously investigated.

We have seen that, among others, four methods are available, the Graphic Power Factor meter probably being of little use, and may be rejected. The single phase meter method is cheap and simple but assume balanced load, and also is of no use where power is sold on a maximum demand basis.

The third method of connecting standard watt metrs or watthour meters to register proportional to the wattless component would seem to be most preferable in cases of unbalanced load of widely varying factors, both for power sold on a maximum demand basis, or kilowatt hour basis.

The fourth method, the compensated meter, is applicable for load, the power factor of which is fairly constant, and has the advantage of reading kilowatt hours at contract power factor directly, provided the meter with correct compensation can be chosen.

A discussion by the various members of the member companies, giving their experiences with different methods of determining consumers' power factors, would be of much benefit.

Respectfully submitted,

J. C. Merritt, L. W. Pratt,
A. H. Winter-Joyner, Wm. Volkman, Chairman.

The President: Before proceeding with the discussion on this paper, I understand Mr. Grier, as Chairman of the Committee on the President's Address, has his report ready. I will ask him to present it.

Mr. Grier : Mr. President and gentlemen, I will let you into a little secret. The President suggested that this report be given to the Class A meeting rather than now. I think it was his modesty which induced the suggestion. The members of the committee were not quite agreeable as to that, because there were one of two observations in the way of appreciation which they wished to make, and they naturally preferred to make them before all the Association rather than before the more exclusive body. My general observations I reserve, then, to the end.

In the first place, this report of the President might perhaps have included a citation of the resolution passed by the N. E. L. A. But, as those of us who were present this morning know, the President, with a sense of fittingness, suggested that that be transmitted by Mr. Martin rather than by himself. But in view of the fact that it is in a sense a portion of the report of the President, I am authorized by the committee to say that in its judgment, it would be a very happy thing if we find our way to passing a resolution virtually the same as the one passed by the N. E. L. A., making only such changes as the differences between the two countries necessitates. Those of us who listened to that resolution this morning will, I am sure, agree with me in thinking that we could not better it and that we should place ourselves in a very happy position by virtually adopting it for ourselves.

In the fore front of the report is a reference made to the financial aid given by or through the United States Government in respect of certain companies. We do not understand that the President suggests that we make any representation to the Canadian authorities that they should do the same, but we note with interest and sympathy, those remarks, and our trust is that, if occasion should arise, there will be appropriate aid given by the Government in respect of any companies whose exigencies requires that they should be helped during this period of emergency.

Next, the committee notes, with entire sympathy, the expressions made by the President to the loyalty of the employees, including specifically in his remarks the clerical staff. We endorse very heartily the view expressed, that the companies should show their appreciation of this loyalty upon the part of their employees in every way possible.

The next point which we note is that the companies, especially in these days when man power is of such tremendous importance, should do everything within their power to assist towards the safety of the employees. This point cannot be too strongly insisted upon, and we endorse very heartily every expression to that effect.

Then the President has alluded to the great necessity of seeing that there is no waste of power at the present time. The committee

sincerely trusts that all the members of the Association have given due weight to these very serious and grave considerations which the President has urged. I need not argue the point before you. I am convinced that you entirely agree with the committee when we say that we again endorse these expressions, and trust that all will do their very best, themselves, and by influence upon others, to see that there is no unnecessary waste of power at this time.

The President has given the view, in his report, that it would be justifiable, in the case of certain companies at all events, to raise their rates in order to meet the various financial difficulties which at present they are experiencing, including, of course, the very serious matter of increase in the price of material, and increase in wages, etc. So far as the Committee is concerned, it feels that there should be no sort of complaint if, in any cases where a raising ot rates is necessitated by the experience of a particular company, there should be appropriate and proper raising of rates in order to meet the present difficulty.

The next point is one of very considerable importance, and I find myself somewhat at a difficulty when I come to deal with it, a difficulty arising from a deep sense of the gravity of the whole matter, and those remarks are with regard to the going forward at the present time of works as to which, I believe, it is not even pretended that they will be finished during the course of this war.

Our view is that no one should be allowed to go into any exploitation at the present time which in any way cripples the financial resources of the country. (Applause). If one puts it in that general way, then one's observations are relieved of any possible charge of their being unfair or harsh. Supposing that these very things were being attempted by private concerns or by private individuals, I venture to say that you would have action at once upon the part of some loyal citizens to have the work stopped upon the score of our duty to the civilized world at the present time.

Now, this feeling is so deep that we hesitate to suggest action. At all events so far as the Committee is concerned it can make no recommendation, it feels, because the matter is so large, is so grave, is so serious. Of course, if the Association as a whole, at any time determine to place itself upon record, why that is a matter for the Association to decide upon. To speak frankly, the situation is always one of extreme difficulty. Just observe what it is. Here are various companies—all of them I believe actuated by the force of loyal motives, composed of men who would dare any man to say of them that they are lacking in loyalty, and yet they are absolutely impotent when it comes to the upraising of their voices in protest. Instead of any such protests being held up to praise, as is the case of protests by other loyal citizens in other walks of life, they are laughed at and those making them are further oppressed. There is nothing apparently that

we can do which gets to the ears either of governments or of people.

It is a situation in which apparently there is no good in being reasonable, there is no good in being fair, there is no good in trying to discharge one's duty, there is no good in exploiting qualities which seem to you to be good or admirable qualities. I believe we are all at one upon the subject; we deplore the situation. At this time when we are told to save every penny that we can, at this time when we are told that man power is absolutely essential, at this time when farmers are finding it difficult to have their lands properly looked after, at this time when the Dominion Government has given up for the time being such a tremendous work as the Welland Canal, at this very time, works which cannot be finished in time to be of use in the war are being gone on with at an expenditure of millions of money, and those who direct the expenditures, instead of being criticized, are held up to praise and admiration.

It is a pleasant thing to turn from the contemplation of such a subject as I have just been dealing with to the concluding remarks of the President, where he speaks of the advisability and desirability of any member company in technical difficulty at any time, corresponding either with our Association or, through the proper official, with the N. E. L. A. So far as this Committee, which I now have the honor to represent, is concerned, it very sincerely and heartily endorses that suggestion and trusts that it be not treated as merely a conventional observation, but that member companies may really avail themselves of the opportunity which is afforded them of getting the accummulated wisdom of the various companies which comprise this Association. We sincerely trust that this suggestion will be very heartily carried out.

And now, in conclusion, the Committee, speaking more diffidently, since the maker of the report is here, wishes to express its very keen and lively satisfaction with and appreciation of the report of the President. It is not the first report which we have received from him —with which we have been greatly pleased, but it is very emphatically the case here and now and in reading the report we realize that it is the report of one who not only has made to us a good report as President, but who also, as President, in all his activities, has shown the greatest possible interest in the welfare of the Association and has demonstrated to, at least the satisfaction and judgment of the present speaker, that it is very desirable indeed that yet further reports should issue from the same President of the Association. (Applause).

The President: Gentlemen, we will refer the acceptance of the report to the Class A members meeting.

You have heard the report of the Meter Committee, and we will defer the discussion of all these papers—if you will kindly take notes, until the close of the Rate Research Committee Report, No. 8 on the

program. They are somewhat analogous, and probably we will save time by that means.

The next report we have is the Commercial Light and Power Sales Committee Report, by Mr. H. E. Randall, of the Shawinigan Water and Power Company.

Report of the Committee on Commercial Light and Power Sales

H. E. Randall, Chairman

To the President and Members of the

Canadian Electrical Association.

Gentlemen:

In presenting our report herewith, your Committee has followed with a few modifications, the subdivision set forth in report of last year and has tried to carry out in a concise manner the extension of ideas there presented, up to the present time.

Lighting Sales.

Residence Lighting.—The use of semi-indirect, indirect and dense ornamental lighting units has been increasing throughout the past year, due to the softness and uniformity and pleasing appearance of the light obtainable from them, together with the not too exorbitant cost of operating such lighting units, brought about by the use of high efficiency lamps, the general tendency to-day is to make the lighting of the house more in accord with the ornamentation, and to eliminate the use of bare, ugly lighting units in an otherwise artistic room.

This increased use means, in spite of high efficiency lamps, a very materially increased use of electricity and one which warrants the increasing attention of the central station, and can probably best be handled by the use of specialists who will indicate to the consumer the advantage and disadvantage of various lighting units, and will in this way assist in bettering the class of lighting in residences along the lines of pleasing appearance, softness and uniformity, all tending toward the more secure position of electricity as the ultimate source of artificial illumination, equalling—if not surpassing—daylight. This tendency will undoubtedly react very much to the advantage of the central station.

Store Lighting.—The same general conditions which have brought about the softening of the source of light in residences have been even more plainly manifested in the lighting of stores.

The present-day merchant is daily becoming more convinced of the usefulness of high grade lighting in bringing customers to his store, and pleasing them when they are there.

Window lighting, due to the more aggressive spirit of the stores and the results obtained in store lighting, has made remarkable strides.

The use of very high lighting intensities in store windows, properly produced by suitable fixtures concealed from view and distributing the light uniformly over the display, is coming into more general use.

This recognition of the value of good lighting of the storekeeper is a fertile field for the central station, due to long burning hours and the large units taken, and should be cultivated intensely.

It is interesting to note that in those sections of the country where window lighting has been reduced on account of power shortage, the storekeepers report that they never realized the great value of proper window lighting until deprived of it.

Industrial Lighting.—The central stations of Canada have played an important part in the production of munitions in a way not usually thought of, that is, by assisting manufacturers to increase their night production, and their day production in dark parts of their factories, by adequate, properly designed factory lighting.

The effect of such lighting is incontestably to materially increase the production possible with old-time factory lighting, and to make possible a night production equal to the day production.

At this time of shortage of man power also, there is the other aspect of a very material reduction in industrial accidents brought about by adequate factory illumination.

The necessity and the usefulness of this type of lighting is so apparent to-day that every central station should immediately look over its field to determine if it cannot aid in munition production, or in general industrial activity, by assisting the manufacturers in properly lighting their factories, to the mutual benefit of both the manufacturers and the central station for whom the high load factor of this lighting service should be a material benefit.

Outdoor Illumination.—The use of flood lighting for the lighting of large spaces has gone forward rapidly during the past year, for night work on construction jobs, for working in large industrial store yards and for police protection around plants of every description.

The use of flood lighting at night has demonstrated its usefulness in making every passer-by a policeman, thus allowing more efficient protection to our factories, waterworks, and shipyards, etc., without materially increasing the police force, and in some cases allowing efficient police protection with a diminished police force.

A new use which is coming to the front for this type of lighting is the lighting of the area around a burning building to assist the firemen at night and to prevent theft.

Many American cities are now using flood lights, erected on the corners of the high buildings in the busy sections of the city, for intensely illuminating the corners where traffic congestion exists—this supplementing the ornamental and ordinary illuminations existing at these points.

Wherever tried, the reduction of accidents and the ease with which traffic can be handled at night without a policeman has been amply demonstrated, and is leading to the use of this type of lighting for corners in the less conjested districts.

Street Lighting.—Extensions to street lighting services, due to general war conditions, have not been numerous during the past year, it being the general tendency in those sections where street lighting contracts are expiring, or where new types of street lighting are being considered, to continue with the present type of lighting until a more favorable cost for lighting units exists, as otherwise street lighting services, which are very largely a capital cost proposition, will be materially increased, perhaps to the detriment of proper street illumination.

There is a tendency, however, to change from arc lighting systems to high efficiency incandescent lamp systems and to make extensions wherever possible on the incandescent lamp system, due in considerable measure to-day to the lower first cost of the incandescent system, and its lower maintenance cost, thus freeing men for other services.

The use of bare incandescent lamps is practically discontinued in sizes over 100 c.p. An extensive use of glassware which properly distributes the light for street lighting purposes is becoming evident.

Daylight saving, which came into effect in this country in the early spring, has not been in effect long enough to accurately determine its effect on lighting income, but it would presently appear that lighting income during the summer months will be decreased some 10 per cent, which, however, will probably be made up by the increased use of light which generally follows upon a reduction of lighting bills, which should be of considerable assistance in increasing lighting income during the winter months; so that although this feature should be carefully reported on next year, it is probable that the gross income over a year's period from lighting service will be actually increased after a few years' operation of the daylight saving law.

Moreover, the increased demand for domestic service as set forth later in this report, will, during the summer months, if properly cultivated, more than offset the slight decrease in lighting income which will exist during this year and a few years to come.

It seems evident that the tendency to-day is for the consideration of electric lighting, not merely as a plain, ugly source of light, but as a means of producing a soft, pleasing, properly distributed, artistic illumination, which can be obtained at low cost, and which is beyond competition.

The uses of light in an industrial way are playing an important

part in business and in the production of munitions and this role is becoming much more generally recognized.

The central station may, therefore, with some degree of satisfaction review its activities in the lighting field over the past year, and should endeavor to play a still more important part in the lighting field in the years to come.

Power Sales.

The demand of the central stations for the supply of power in large quantities on short notice to munition plants has continued and increased throughout the past year. The supplying of this power has in some sections of the country produced an acute power shortage, which has occasioned more careful study of power delivery conditions to munitions plants.

Such studies have in many cases indicated that the supply of power to these plants, which was assumed originally to have been of a very temporary nature, was carried over lines which were of small capacity and which occasioned very heavy losses in power as the manufacturers increased their loads. In many instances the handling of these loads, or increases thereto, has been more satisfactorily carried out, both from a service standpoint and a saving in power standpoint, by the delivery of power to the larger munitions plants over high tension circuits with transformer equipment at the manufacturing plant.

Power demands have also increased materially, due to coal shortage, which has again brought to the front the more economical production of power by central station means, as demonstrated by the Fuel Controller's coal saving through the use of central station plants for power supply rather than the isolated plants in the various factories.

Those central station companies generating by hydraulic power are in this way very materially assisting in the elimination of the coal shortage, and thus helping in the solution of the transportation problem.

The power shortage has called to the attention of the companies suffering from it the necessity of being much more careful in their sale of power, and the conditions of sale, among which perhaps the most important is the regulation of power factor. In the past, due to loose power factor conditions and non-enforcement thereof, power lines have become encumbered with motors of excess capacity or of improper voltage, or improperly repaired, with the result that many companies were supplying motor loads at a very low power factor, materially decreasing their line capacity, their generating station capacity and transformer capacity, all of which is so urgently needed at the present time for munitions and general purposes.

Most companies throughout the country are now strictly en-

forcing their power factor regulation clauses, or writing in new power factor clauses in their new contracts with the result that the users of power, due to penalties involved for poor power factor, are readjusting their equipment to operate at a proper and reasonable power factor, which has worked very much to the benefit both of the central station and of the consumer.

The power shortage in some sections of the country has made necessary the curtailment of the supply of power to non-essential industries, and if relief is not afforded will tend to the complete elimination of power supply to such industries. It would seem to your Committee that provision should be made, by Government assistance or otherwise, just as much to the power company as to the munitions manufacturer, inasmuch as the power company is supplying one of the most important raw materials—that is power—to so enable the power company to maintain its business so that the normal manufacturing activities of the country may go on, thus tending to stabilize the industrial conditions in the country after the war, and in many instances allow the establishment or expansion of industries to supply export demands which were previously supplied from Germany. If this country is to maintain its industrial place and to make this place a more important one, the activities of legitimate, normal industries of the country, even although not strictly employed on munitions work, should be encouraged and assisted in every proper manner, and should by no means be allowed to be stamped out, due to a shortage of power.

We also feel that new application for power supply for motor power uses should be met in so far as is physically possible inasmuch as it would build up the industrial activitiy of the country and make for a more stable condition after the war.

Domestic Service.—Nowadays the use of electricity in the home is far from limited to the simple electric light, but it is becoming more and more important for other domestic uses, such as toasters, grills, percolators, flat-irons, vacuum cleaners, washing machines, dish washing machines and other small motors; and to a larger degree the electric range and electric water heaters. Your Committee, therefore, believes that this report should comprise a section devoted to these domestic uses of electricity outside of electric light, as these bid fair to far surpass the income from domestic electric light, and under present-day conditions serve also as important conservers of fuel, thus aiding the national cause.

The use of the smaller of the household appliances noted above has increased greatly during the past year, due to the difficulty experienced by householders in obtaining domestic help, and they have, therefore, turned to the Universal Servant for assistance and have been in this way made familiar with the great assistance that electricity can offer through the above appliances.

The familiarity with domestic electric appliances which the house-

holder has thus gained, and the absolute success of these appliances, make it easy for the central station to get a very much increased amount of this business during the present year, and campaigns with this in view should be carried out.

The most important source of domestic service revenue is the electric range, from which an income of between $35.00 and $75.00 a year can in general be secured, which is many times the income from the same householder for lighting service only.

At this time the use of electric range becomes more and more important as it is a conserving fuel, even though the electricity is generated in a steam generating station. The average range will consume something between 100 and 175 k.w.h per month, which generated in a modern steam generating plant would not require more than 200 to 350 lbs. of coal, whereas the ordinary coal range consumes some 600 to 1,000 lbs. a month, thus making a net gain of approximately 60 per cent., which if applied to all the householders of Canada would mean a tremendous difference in the congestion of our railroads and the amount of money sent out of the country for coal. Of course, where water power is the source of electricity, the net saving of coal is 100 per cent.

All companies having available power and who have been supplying electric ranges previously report tremendous increases in the use of electric ranges, which amply demonstrate their success.

We, therefore, recommend that every central station immediately investigate carefully the electric range possibilities and make suitable rates therefor, as we feel the income to be thus obtained will be a most important factor in the central station industry in the very near future.

We further recommend that the sale of all electric ranges be carried out on an installed price basis, so that only one sale has to be made covering complete range, as it is found that where a range is sold by itself it is sometimes difficult to make the sale of the installation on account of its excessive cost in certain sections of the country.

In these cases where the central station does not do the installation work, this basis can still be used by co-operation with the contractors association or contractors in the various cities.

As electric cooking represents a new and advanced type of cooking, it is very necessary that central stations going after the electric range business should be prepared to furnish adequate service, preferably by means of a competent demonstrator, so that all purchasers of ranges will be properly instructed in their operation, and during the first few months of operation periodical inspections should be made to make sure that everything is operating satisfactorily, and to insure the purchaser obtaining all the information which will lead to the fullest success of the range.

The purchaser should be made to feel that attention to details or repairs or any defect with the stove will be immediately and satisfactorily taken care of, and that when a purchaser takes an electric stove he is going to be absolutely satisfied therewith.

While this service is very necessary at the present time, later when the use of electric cooking becomes universal, and as standard stoves are developed, the necessity for this service will probably disappear, as it has in the gas business.

It is already noticeable that manufacturers are following up the suggestions made by the central stations and are in this way obtaining what will soon become a standard range, which will be practically free from minor defects, and which will require practically no attention.

The central stations should continue this policy of suggestions, because they are in the best position to determine the slight defects which exist and the slight changes which may be necessary to perfect the electric range, and we feel certain that all range manufacturers will be very glad to get the suggestions from central stations.

Electric water heating is becoming more and more common on all services supplied from hydraulic plants, and as stated in last year's report, it seems certain that the electric water heater should always be installed whenever an electric range is installed on systems with such a source of power supply.

Marked improvements and betterments in electric water heaters have been brought about during the past year, and heaters now available are giving excellent service.

On those installations on electric water heaters in which furnaces are used for water heating in the wintertime and the electric water heater only used in the summertime, water heating load gives a more uniform yearly load curve for the installation, as it is thus prevented from over-lapping the lighting peak in the winter and fills up the valleys of the load curve which normally exist in the summer.

Most central stations are supplying water heater services on a flat rate basis, either directly or on a double throw switch, so that electric stove and electric water heater cannot be used simultaneously.

Arc Heating Processes—during the past year have expanded in use by the industries reported last year. Calcium carbide, ferro silicon and steel have very largely increased, probably in the total by 50,000 h.p., whereas the production of zinc by arc process has been discontinued.

The use of the electric steel furnace for average steel foundry practice seems to have become assured, as for the average small foundry it offers a means of making a superior steel at low cost and with a freedom from uncertainty which is quite impossible with the methods hitherto used.

It is probable also that electric furnaces of this type will also

be used for grey iron casting, and it might be that in small foundries, casting both iron and steel, the same furnace be used for both.

Central stations should look over their field of operation and call the attention of steel foundries to the use of the electric furnace.

Resistance Heating Processes—have increased materially notably for calcining coal and the manufacture of carbon electrodes, and very largely for abrasives.

During the past year the use of electrically heated japanning ovens has grown to a large extent, both for light sheet metal products and for heavier products. This type of load being a very high load factor is very desirable for the central station.

Electric Welding—has advanced materially during the past year and seems to be now expanding in usefulness for the heavier welding processes. Spot welders are becoming almost universal in replacing light riveting processes.

Electric Bake Ovens—have been installed in many places in Canada and are giving universal satisfaction, turning out a superior quality of bread at very low baking cost. This use of electricity is destined to largely expand in the near future and offers an attractive use for off-peak power, although the business readily stands the firm power rates.

The use of electrically heated muffle furnaces for heat treatment and other purposes is expanding considerably and the use of small electrically heated melting pots for base metals is commencing.

Electrolytic Processes.

No material advances to electrolytic processes have taken place during the past year except for the production of hydrogen, oxygen and chlorine.

Electrolytic generators for hydrogen, oxygen and chlorine furnish a cheap and easy means for the production of these gasses in relatively small quantities for industrial uses.

Industries requiring these gasses are becoming more and more numerous, and due to the difficulty of obtaining these in the open market, many companies are installing their own gas generators.

Industrial Trucks.

During the past year the use of small storage battery trucks and tractors has increased considerably.

These trucks are used in industrial establishments for moving materials through the plants, in railway stations for handling baggage, mail and express to and from trains, for freight terminals, steamship docks and a great many other purposes. These trucks replace a great number of men used as truckers, and not only free them for the National Service, but materially decrease the cost of

service. This load, being in general an off-peak battery charging proposition, is a very attractive one for the central station.

General Resume.

This report of your Committee is intended to concisely state the advances in electric lighting and power sales which have taken place during the past year, and advances in the use of electricity.

A review of this report must indicate the tremendous value of the central station industry to the country and the most important part that it is accomplishing in the production of munitions, in the advancement of industry, in the solving of the servant problem in the home, in the conservation of fuel and thus in transportation, the conservation of man power, and in many other ways—all materially assisting in the attainment of the success of our national efforts and in the building up of the industrial condition of this country, not only to be of service in winning the war, but to be of service in the general upbuilding of the country after the war.

Respectfully submitted,

F. M. Dusenberry,	W. H. McIntyre,
M. C. Gilman,	L. W. Pratt,
R. B. McDunnough,	H. E. Randall, (Chairman).

The President: We will now proceed with the paper of Mr. E. N. Hyde, Representative on N. E. L. A. Lighting Sales Bureau.

Mr. E. N. Hyde: Mr. Chairman, gentlemen, I wish to take this opportunity of acknowledging the distinction that you have conferred upon me by permitting me to represent the Canadian Electrical Association in one of the departments of the Commercial Section of the N. E. L. A. As has already been stated, the work of the N. E. L. A. has been confined to correspondence and there has been no meeting during the past year where matters were brought up for individual discussion. The trend of affairs affecting the activities of the entire Commercial Section of the N. E. L. A. has been in connection with war measures, and as a result a great many developments of importance have been taking place that should not be discounted at all, but which, because of their military nature are therefore to a certain extent secret, and should not be divulged. With this in view, gentlemen, I submit the following:

War Work of the National Electric Light Association

One of the important items which will be presented at the Atlantic City Convention will be the figures setting forth the saving effected in the consumption of coal by having heatless days and shutting down sign lighting and other unnecessary illumination during the past season. It is expected that these figures will be surprising inasmuch as the aggregate amount of coal saved runs into many tons.

Further war work has been accomplished through the representation of the Association on the Board of Gas and Electric Commissioners of Washington, who have found it advantageous to call in members of the Electric Light Association, as well as members of the Illuminating Engineering Society when problems strictly pertaining to illumination were encountered.

The special equipment for lighting battleships, munition factories, harbors, cantonments and aviation fields have each been submitted for solution and the recommendations made to the Gas and Electric Committee generally by the National Electric Light Association and the Illuminating Engineering Society have been adopted and have proven most satisfactory.

By the proper method of lighting it is now possible for aviators to land at the proper points within enclosures surrounding hangers without danger and with accuracy, which eliminate possible collisions and effect landings near the respective hangers which were the objective points of the aviators on their return flights.

Among other considerations encountered in connection with this work was the necessity of the operating companies throughout the United States meeting the demand for the excess power consumption necessary in cantonments, harbors, etc. Concerted action in regard to this was taken and in order to expedite shipment of the necessary supplies of pole line material and other requirements intercompany connections were resorted to and the warehouse stocks which had been accumulated by the operating companies were released for the requirements of the Government. Estimates of power consumption at these various points of military concentration were at the best only approximations, but with power available from central stations any excess current needed over and above that approximated was readily available inasmuch as the central stations had an available supply which was not limited as would be the case were isolated plant equipment installed.

Considerable other work in connection with military strategy was also accomplished satisfactory by plans provided by the National Electric Light Association to the Gas and Electric Committee, in which Mr. J. W. Leib, Vice-President of the New York Edison Company, has taken a remarkable part. This phase of the work done however, is not open to discussion nor will it be revealed inasmuch as its military character recommends that the work and the results obtained be kept secret.

Respectfull submitted,

E. N. Hyde,

Canadian Representative Lighting Sales Bureau N.E.L.A.

The President: We have a paper now by Mr. P. T. Davies on Rate Research Committee Report.

Mr. P. T. Davies: Mr. President and members of the Canadian Electrical Association, I am afraid it is a case of great minds thinking alike again, because it seems to me, after hearing various Committee Reports, that each and everyone of them has stolen my thunder, but I guess we are all in the same frame of mind in regard to most things, so that any redundancy in this Report I hope you will please excuse and figure that it is only another hammer blow to drive home the points that the other papers have brought out.

Report of Committee on Rate Research

P. T. Davies, Chairman

To the President and Members of the
Canadian Electric Light Association:

Your Committee begs to report that they have carefully watched the trend of current events with a view to incorporating in their report any changes in rates or any tendencies in public opinion and have noted the following matters as being, in their opinion, worthy of notice. Using the chart which was designed last year, Fig. 7, as a basis for their investigations they have looked into the following matters.

Contracts.

Legal.—An outstanding matter for Canada has been the settlement of the Tramways Franchise in the City of Montreal by a Board appointed by the Provincial Government. The matter of a new franchise for the City of Montreal and its surroundings has been the centre of political agitation for a matter of some six years, but in the Fall of 1917 the matter was taken out of the hands of the Civic authorities and placed in the hands of a Commission, who had authority to study the details and to report back to the Provincial Government for their ratification.

The Contract, or Franchise, as finally approved is a three- sided agreement whereby the Company is protected in its investment, the public protected on the rate of fare, and the City is protected on the point of view of taxation and general conditions involving routes of cars and maintenance of service, etc. The agreement is a very long one, but the special point worthy of notice is the fact that the company is permitted to charge fares which will cover their bond indebtedness and up to a reasonable percentage on the common stock. After providing for renewals and the city's portion, a fund is created into which all surplus earnings are placed. When this fund exceeds a certain amount, the fares are automatically reduced, and if the reduction does not effect this fund then further reductions may be ordered. If, however, the fund is eaten into then rates are automatically raised again.

The interesting point about this arrangement is that the Province

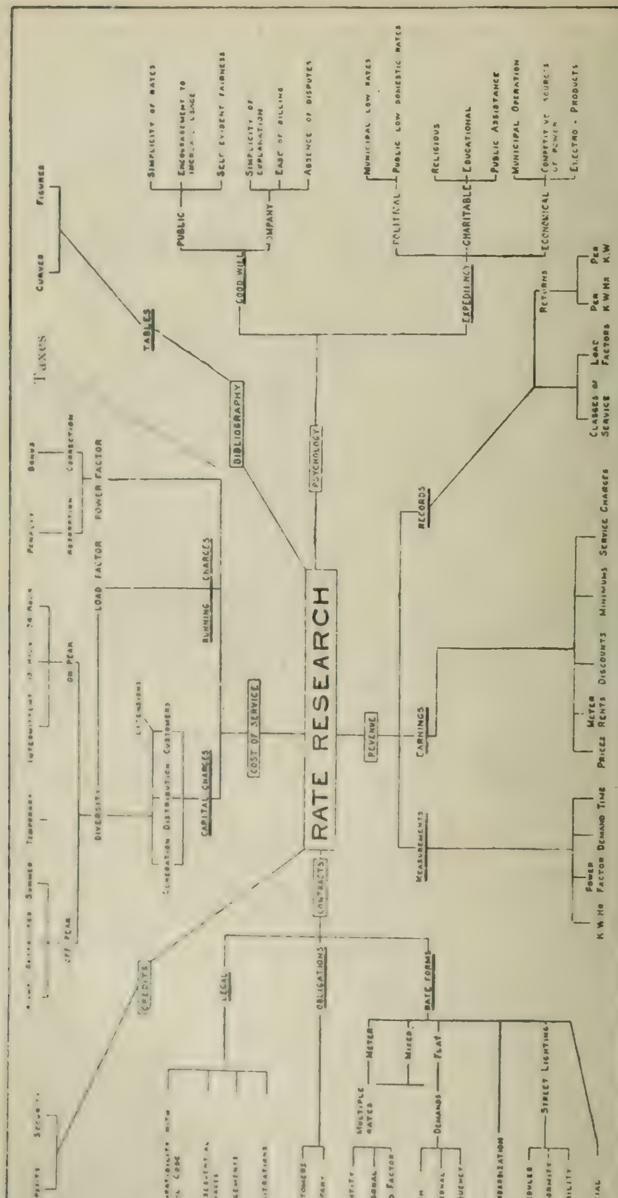


Fig. 7—Chart showing relation of the various subdivisions in the Report of Committee on Rate Research

of Quebec has followed the lines of the United States Government in protecting privately owned public utilities, and, at the same time, protecting the public. While this policy has been in force throughout the United States for the past 8 or 10 years and is continuously becoming more widespread, in Canada, on the contrary, privately owned public utilities have regularly been singled out for political activity with a resulting insecurity of investment, which has tended, especially in Ontario and the West, to curtail their development.

The Committee would call your attention to a type of Card Contract in use by one of the member companies (Fig. 8). The average contract in use by most of the companies contains a large number of regulations which frequently have the effect of frightening a prospective customer. Similarly they are not suitable for convenient filing. The card form shown refers to the Rules and Regulations of

Form 113-1M.-12-17-9786

Name.... ....

No............... Address...................... Date. ....

To The SOUTHERN CANADA POWER Co. Limited

Operating..

Please connect the premises at......................................to your ELECTIC LIGHTING service subject to your rules and regulations as adopted from time to time for which service I agree to pay monthly at your Office at the following Rate..

Subject to a minimum monthly payment of.............................. 100 dollars ($....................)
Meter rent....................per month. Subject to a discount for prompt payment of
if paid within discount period. } ....%
This agreement to be effective for one year from above date and to continue in effect thereafter until notice in writing of 30 days shall be given for the disconnection of the service.

....
Witness *Applicant*

The forgoing is signed by the applicant after reading and receiving a copy of same, and is subject to the Company's acceptance by letter addressed to consumers within thirty days. acceptance may also be made by making connection at the point of delivery.

Received from ....the sum of ....dollars ($..........)
or letter of security No. .... as guarantee for the fulfilment of above application such guarantee to be returned when the service covered by this application is discontinued.

Householder ? Yes / No. ....
For The SOUTHERN CANADA POWER Co Limited.

Fig. 8—Type of card contract form

the Company, which are necessarily kept on file and available if required. This card when signed constitutes an option on the customer's business for a period of 30 days. The card also acts as a deposit form, customer retaining copy.

Obligations. The obligations of customers in Canada in view of the shortage of power and high cost of machinery have been increased in the matter of providing proper apparatus, especially with a view to the improvement of power factor. Whereas in the past power factor clauses have not been vigorously applied, nowadays all companies are requiring the customer to keep their power factor within reason-

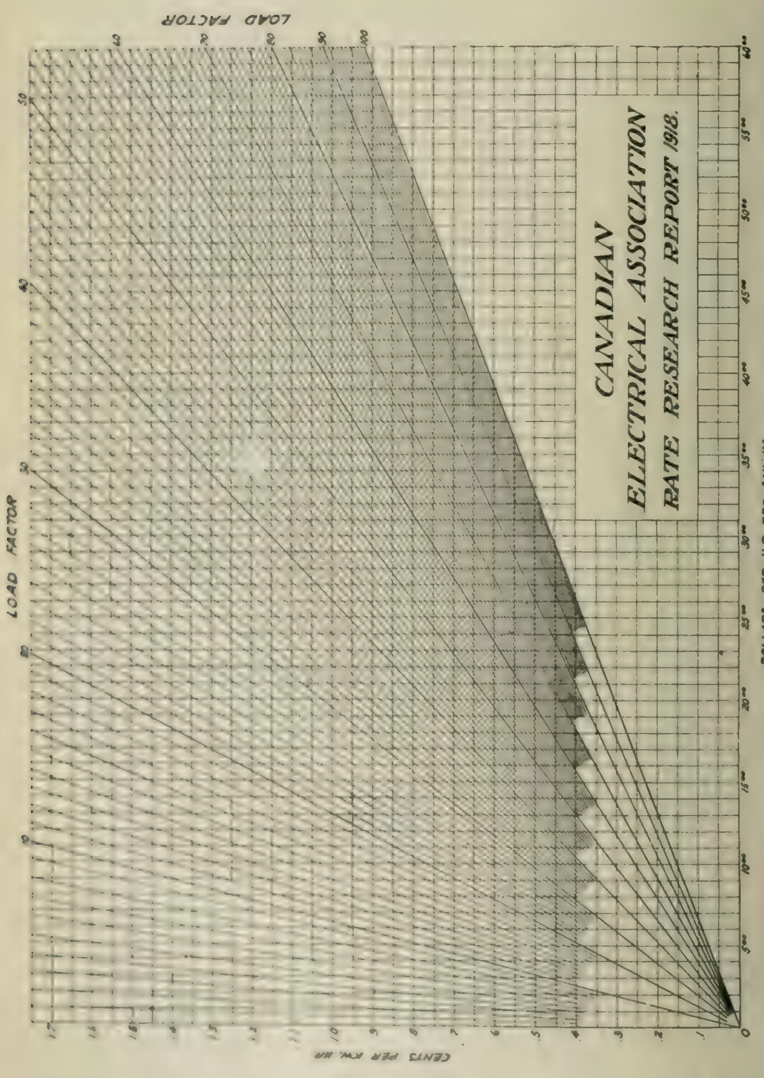


Fig. 9—Curve for the comparison of rates in various rate forms

able limits at all times and to pay for any deficiencies. The question as to whether the power factor should be computed at the time of maximum load of the consumer's installation, or at the time of maximum load of the company's system, or whether the average power factor taken by the customer over the whole period of his operation should be taken as the determining factor, is not yet standardized.

Rate Forms, Special.—In the matter of rates for summer business, it is a known fact that no meter rate can produce enough revenue on the average summer customer to pay the interest on the investment, and it should be noted that in the United States rates as high as 18c. per kilowatt have been tried.

One of the member companies has instituted a new type of rate this year with a view to getting, at least, fixed charges out of these customers, the rate being $1.00 per outlet for the first 10 outlets, plus 50 c. per outlet for the excess over 10, payable in advance, plus 4½ cents per kilowatt hour. It is found, generally speaking, that summer customers get away without paying their last bill and are very difficult to trace. In the case of the above rate a good deal of the charges are being collected in advance, and the company does not stand to lose so much revenue from "skips."

Cooking Rates.—A study of the rates charged for Electric Cooking in the United States shows that the prevailing rate is 3c. per kilowatt hour straight. While this may seem high to those who are accustomed to the low rates prevailing in Winnipeg and Ontario, nevertheless electric cooking at this price is within the economical reach of everyone.

An average taken over a number of cases shows that 25 kilowatt hours are required per person per month, and at the above rate of 3c., this represents 75 cents per head. After five or six persons are catered for the usage per head drops off very fast and a usage of over 200 kilowatt hours per month is quite exceptional.

Various rate forms are being tried out by member companies for Electric Cooking, but the Committee has no hesitation in advising member companies that a 3c. net rate is an acceptable and profitable rate.

Revenue.

Measurements.—No new instruments have been devised for the cheaper measurements of maximum demand and the lack of such instruments is still felt.

The same thing applies to measurement of power factor.

Psychology.

Expediency—Political.—The Rate Research Committee feel that they can hardly present their report without referring to the political significance of the shortage of power in the Niagara district as this is

[illegible] [illegible] Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Graphic ____ Card No. ____

See also Nos. ____

Name ____

Address ____ Division ____

Kind of Business ____ Party to see ____

POWER RECORD

	[illegible]	TERM	EXPIRY DATE	FLAT OR METER	KIND AND CLASS OF CONTRACT	VOLTS	PHASE
A							
B							
C							

	Horse Power Contracted For	Additional Order No.	Date	H.P.	Additional Order No.	Date	H.P.	Demands Length	Number	Apparatus on Rental
A										
B										
C										

BILLING DATA

	Price Terms	Discount Cash	Other	Apparatus Rental Monthly	Minimum Monthly Payment				
A									
B									
C									

TEST RECORD

	Date	Test No.	P.F.	KW. H.P. to bill		Date	Test No.	P.F.	KW. H.P. to bill		Date	Test No.	P.F.	KW. H.P. to bill
A					B					C				
A					B					C				
A					B					C				
A					B					C				
A					B					C				

Over for Special Conditions and H.P. Connected.

Fig. 10—Front of power customer's record card

Special Contract Conditions ____

DETAILS OF MOTOR INSTALLATION

Date	¼	½	1	2	5	7½	10	15	20	30	40	50	75	100	150	200	TOTAL No.	H.P.

OTHER APPARATUS ____

REMARKS ____

YEARLY STATISTICS

YEAR	KWH	REVENUE
19		
19		
19		
19		
19		

Fig. 11—Reverse side of power customer's record card

a case where political action has resulted in a curtailment of necessary supplies which may have a very important bearing upon the positions of the Allies in the great war. In the Niagara district, on both sides of the river, are plants whose output is essential to the successful prosecution of the war and this output is absolutely dependent on the supply of power. Political action, at any rate on the Canadian side placed these plants where they are, although in other parts of Canada ample power was available and is still available for their requirements.

The output of these plants has been regularly and seriously curtailed owing to the fact that the political machine in Ontario over-sold their output in a blind manner, and gambled upon Providence to help them out. Even to-day it is reported that the output of the plants, instead of being supplied to the necessary and essential war industries, is being diverted to light up the small towns and villages far distant from the plants. The political significance of this action is only equalled by its immorality.

Bibleography.

The weekly issue of the Rate Research Bulletin of the N. E. L. A. will keep the member companies supplied with the most recent information, and those of our member companies who are not subscribing to it are strongly advised to do so.

The Committee publishes, herewith, a form of Rate Curve (Fig. 9) in use by one of the member companies hitherto unpublished. By the use of this plan any rate form can be compared with any other rate form within the limits of the form as to price. The lines radiating from the origin are load factor lines, and at any rate given the total cost per horse power per annum is immediately readable. This applies practically to any rate form. A card record system for taking care of power customers is also extracted herewith (Fig. 10). The months of the year, which are printed on the upper edge, are for use for testing purposes. If a customer's installation needs to be tested in April and August tabs are placed on the card for these months and the customer's installation brought up for testing automatically in this manner.

Service.

The cost of service has naturally increased in all parts of the country, but it is with pride that the Electric Industries in Canada can point to the fact that the cost of service to the ordinary consumer has not yet been advanced. In the case of short term contracts on munitions business higher prices are now obtainable than originally, but in most cases the rates charged are in no way comparable with the cost of any other kind of service.

Taxes.—The Committee find that the original chart did not include the sub-heading "Taxes" and are, therefore, including one in Figure 7.

In the province of taxation, a new impost has been developed in one of the towns of the country. This consists of a tax of 25c. per month on all users of electricity. This tax was successfully passed over to the consumer, although the company supplying the current has to do the collecting. Any tax of this kind is liable to become general and member companies are warned to take steps to see that the tax is placed on the consumer and not on the company, and, secondly, that such tax is kept as low as possible, as even 25c. per head, per month, has had the effect of causing some users of electricity to discontinue same.

The whole respectfully submitted,

J. B. Woodyatt, M. C. Gilman,
A. A. Dion, P. T. Davies, (Chairman).

The President: Well, gentlemen, I am sure we are very much indebted to these Committees for their work, seeing the great shortage of men we have and how busy these men are. But we have found from experience, if you want to get any good work done you have to get a busy man to do it. I hope Mr. Davies and the meeting will understand that most of the redundancy in his paper, especially about Niagara, seems to be from my address, and that I had no access to his paper before I wrote mine.

These papers are now open for discussion, and I hope we will have an animated discussion.

Mr. Davies: In connection with that meter which is compensated so as to read correct at 85 per cent. power factor, do I understand that when the power factor goes up to 90 or 95 per cent. that the compensation only affects the registration by 3 per cent., and that in case the power factor runs above 85 per cent. that the customer will get compensated. It is very necessary to be quite sure on that point, because we do not want to bonus a customer if he goes above 85 per cent. at the full rate of the contract and have him sell us back energy at the rate we are selling him. I know, because I have come by cases like that. One company put it over everybody. They put in the contract that if the power factor varied from 90 per cent., so the rate was to be figured. We did not notice the word "vary," but when it came to application they put in apparatus to give 97 per cent. power factor, and they reduced the rate by 90-97. I do not know whether that compensating meter gives a customer a bonus if you get above 85 per cent. or not, but if it does, it should be very carefully looked into before being used.

Mr. [illegible]: I will have to ask Mr. Merritt to answer that, as he has studied that particular type of meter more than I have.

Mr. Merritt: I think the shape of the curves will show that better than anything else. Of course the compensating meter is applicable only in cases where the power factor is roughly constant, because the shape of the curves will show you if you have a meter com-

pensated to read 85 per cent. of k.v.a. at 70 per cent. p. f., and if the power factor is appreciably different than this amount, the registration is in error. It seems to me the most satisfactory meter of this compensated type would be the higher curve on Fig. 5, because with this meter you may have an enormous variation of power factor roughly from 70 to 95 per cent., without a variation of more than 3 per cent. of k.v.a. registration.

Mr. Davies: Will be only 3 per cent. out?

Mr. Merritt: Will be only 3 per cent. out.

Mr. Davies: The question is a very interesting one, especially the point as to how you are going to apply it. On a flat rate contract it is usually applied to the point at which a customer is billed, i.e., point of maximum demand. But that may not be the whole amount that you are entitled to. I have used a method myself of installing two single phase watt meters in all cases, and taking average power factor throughout the month and increasing demand according to the average power factor. I fancy we are entitled to figure correction for average power factor, even where we take the customer's power at maximum load.

In that connection I might say I designed a meter and a company promised to get it out. They never did however. I really think that it would be the solution of the problem—a simple graphic wattmeter with two pens, i.e., two single phase recording meters with pen on each single phase element, marking on the same chart, giving you continuous chart of power factor and also of the load. In order to get the load you add the two curves together. In order to find power factor you get the ratio of the readings and determine the ratio in direct ratio of the readings. I do not know why the people do not go ahead and make it.

Mr. E. N. Hyde: I have had some experience with meters in connection with Philadelphia Electric Company some years ago; I think I have made something like 5,000 or 6,000 tests of various kinds. In connection with those tests there are certain characteristics which seem to be inherent in any specific design of meter when compared with another. In order to illustrate I am going to recite an experience with six different makes of meters in common use at the time, which I admit is considerably ancient as compared with the development of the present day. I used a Weston portable indicating wattmeter for a standard to test the wellknown T.R.W. meter, which being of commutator type and without iron, was supposed to be built largely on the dynamometer principle. A second meter tested was one known as the Diamond, and another a Type K, Fort Wayne, and another a Type C, Westinghouse, as then produced by the Westinghouse Company, under that letter, which possibly might be confused with a later Type C, a confusion I wish to avoid. An installation being unsatisfactory to a customer was investigated and it was

ascertained that two induction fans disturbed the accuracy of the meter readings as compared with their accuracy on known non-inductive leads. The T.R.W. was inaccurate to the extent of 30 per cent. In other words, it recorded 30 per cent. more than was shown on the Weston Portable type indicating wattmeter. There was another meter of the ampere hour type, readings on which were taken in order to ascertain what affect the disturbance in the angle between the voltage and current wave forms produced, and that instrument showed 300 per cent. of indicated load. As to the other instruments none of them approximated the 30 per cent.; they were all higher in the number of watts, being recorded on the cyclometer as compared with those which should have been recorded, where the readings of the Weston standard were taken as being 100 per cent. correct.

I know that in making these remarks the Weston standard was not taking into account any power factor, it giving an indication of actual useful watts.

The point I wish to bring out in making these remarks is that with meters of the induction type, compensated wound, there seems to be a variation in performance with variation in wave forms resulting in a change of accuracy for each variation in the power factor, and that some of those characteristics have a tendency to speed up meters rather than retard their number of revolutions for a given indicated effective watt reading and in the above cases it seems to me the revenues were greater than the customer was expected to pay.

If the performances prevail in the meters under discussion they are not taken into account in the calculations submitted by the author of paper just presented.

The President: This discussion seems to be rather confined to the meter people. Anything that requires discussion in the other papers?

Mr. Speers: The main power house of the Algoma Steel Corporation has five 1500 k.w gas engine driven generators, but as we are taking 6,000 h.p. from a Hydro Company, we do not have to operate our entire gas engine plant. The frequency varies about 2 per cent. above and 2 per cent. below 25 cycles and we have some difficulty in paralleling with our engines. Meters will be installed some 3,200 feet from the power house at a point on the steel plant property line which is the official receiving station for the incoming current.

I would like to know whether there is a thoroughly accurate frequency meter made.

Mr. Davies: Recording?

Mr. Speers: Yes. Another matter: these gas engine driven generators are located close to blast furnaces where there is no little blast furnace flue dust in the air. We also have a motor generator

set adjacent to our coal unloading plant. What suggestions can be offered to keep the electrical apparatus clean?

Mr. A. A. Dion: With reference to what the last speaker has just said, I may state that we installed a number of motors in connection with our gas works in the retort house, where they were subjected to a great deal of fine gritty coke dust, and these motors keep giving out constantly. The manufacturers suggested that they be subjected to a special treatment of their own, which was put on and baked on, which would make them dust proof. We were told that this process had been used on motors in the cement factories where the motors are subjected to gritty dust, and that it was quite successful, but it was not successful in our case. After some investigation we concluded to take the motors out of that place altogether. We built a little housing outside of the building and carried the shafts through the wall, long shafts, and in that way we prevented the trouble. We found no way of saving the motors from this coke dust. I should also be pleased to know if there is any other way.

Mr. Randall: The statements as presented in the Sales Report I think are quite accurate. For electric heating there is not enough water power in the country. And, furthermore, it may be of interest to the Convention to know that in the United States it is not possible to supply 20 per cent. of the present power demands by water power, even though all the undeveloped water power of that country was already developed and available. That is, in the United States to-day there are about 150,000,000 h.p. employed commercially. In the United States there are approximately 25 to 30,000,000 possible h.p. from hydro-electric sources developed or undeveloped. In other words, less than 20 per cent. of the present industrial service in the United States could be supplied if the entire water power of the United States were developed. So that adds another light to the possibilities. To speak of one company serving a little over a million people, we would be most glad to take on every house as a consumer for electric cooking service, and it may be done on that basis for about one horse power per house, of maximum demand at the central station. The electric heating of the house would take approximately 20 h.p. per house, which would be quite beyond the water power possibilities of this country.

Mr. Davies: In the Northwest Electric Association Report it was proved, a thing that the average person would not appreciate, that there is more coal required in the kitchen with range with hot water back than when the hot water back was disconnected. The average person thinks he gets his hot water for nothing. But getting down to hard tacks, they don't. It takes more coal when the hot water back is attached than when it is not. There is no doubt about it that the hot water heater or circulation heater is a necessary complement of the electric stove.

But there is one point that has not been brought out in paper, and it is an essential point, and that is: hot water tanks must be lagged and well lagged. The radiation from the average tank at about 140 degrees fahr. is 500 watts. That is straight radiation at all times, normal atmosphere. But lag the boiler well and lag the pipes coming to and from it and you will find you will get away with a 500 watt heater and be able to give the small family all the heat they want. (Voices: No, no.)

Well, let some people say, no. If they don't, the only thing I can say is that the hot water heater is not well lagged.

Mr. A. A. Dion: What would you call good lagging, 6 in. thick?

Mr. Davies: No, about 2—about 2 in. of cement. That is another thing to look into, suitable lagging. There are several made by The Johns Mansville Company. You can make your own lagging—mixed with cement and asbestos and magnesia and cement, and you can lag a tank for about a dollar a piece. We, in the future, are going to sell the water heater with the lagging, all included, and we will see all these tanks are lagged. I think we are going to get away with 500 hot water heaters.

Mr. Gould: I had some experience with a heater like that. We had a 1,500 watt heater and it would not do the work. We found it was useless unless for 3,000 watt. Another thing, about the ranges—there are many ranges installed where I live. The thing that militates against the electric range with us is that the kitchen has to be heated in the winter time in any event and the cost is so great, especially under installation rules in Ontario that it is nearly prohibitory. The Hydro price for the range is $75, and it costs about $50 more to have it installed. Then the people can use it from about the month of May until the heat is required in the kitchen again the Fall, unless they have some other arrangement to heat the kitchen, which many of them have not. These are things that militate against ranges in the place where I live. People well-to-do are able to go to the expense of installation of these ranges for the short period required in the summer time, but the ordinary people are not.

I want to emphasize again that we do not have any success with the heater unless it be a 3,000 watt heater.

Mr. Randall: I can bring a little data on this subject that is rather accurate. The Shawinigan Company, through its various distributing companies, has, since the beginning of the electric range installation on the systems, kept very accurate data on every installation. That is, repair costs, consumption costs, installation costs, etc., and I think we are in a position to bring as accurate data to bear on the condition as can possibly be found. And

I have yet to find out of approximately 400 or 500 installations a single electric range installed three months before the winter period that was left idle during the winter months. We do find that a great many people say: What can I do with it during the winter months? We have a mixed type of rate, demand and meter rate, for electric cooking, and to meet that particular condition we made a reduction for consumers using summer service only, as we could like them to use the electric range in summer only, to flatten the load curve. We have yet to find a customer who has not come back and paid his additional $5 for the winter service.

To come to Mr. Speer's question, which has not been answered. I do not know of any accurate recording frequency meter. But I would like to enquire, as the problem is an interesting one, the relative capacities of the two plants, your gas plant and hydraulic plant.

Mr. Speers: We have 5—1765 K V A machines in our station. The other plant has 20—650 K V A machines. The capacity that is set aside for our 6,000 h.p. is about 8,250 h.p. In other words, they have 2,250 h.p. reserve capacity for us. Then our station supplies, 1,800 h.p., in all 9,000 h.p. for our plant.

Mr. Randall: Why I asked was, it might be an interesting thing to the convention to note that when a large plant was in parallel with a small plant that the governors of the small plant are useless, and that the large plant takes all fluctuations in load within, of course, certain limits. The speed of the big plant is practically constant irrespective of any change of load that could occur on the small system and the governors on the small plant cannot move.

To jump around again, and to speak of our friends, the Hydro, it is most interesting reading to just take their last annual report and look over their power rates. It is most impossible for private companies to sell power to any municipality at the prices they show there. In going over a list of 150 to 200 towns, prices ran from $11.60 to $69.00 per h.p. year with very few under $20.00. Our company, covering a territory of several thousand square miles, has not a single customer paying as much as $69.00.

Mr. Maclachlan: I might touch a point that has not been brought out. In Toronto last winter there was a woman taking a bath and she was killed on 105 volts. I think that is a point that any company handling articles that are going into the home ought to take into very serious consideration. All that happened there was one of the little screws on the name plate came out, the name plate dropped down, grounded the frame of the heater that was in the bath room. The woman apparently put her hand out to move the heater, or do something with it, and was immediately killed. 110 volts will kill almost every time if you get it through wet hands, and in cases of

this kind if it is an extremely difficult matter to resuscitate. In all house installations keep your switches away from your plumbing or away from the radiators. There are far more persons killed by electricity outside of the employees of central stations than there are inside. That is borne out by the records of the Compensation Board of Ontario. If any of you are interested in that subject you can get "Safety in the Home" from the Bureau of U. S. Government, Bulletin No. 75—15c, I think it is. It is well worth reading and gives a lot of valuable information. It is just off the press.

Mr. Davies: Before we get out of order, I would like Mr. Randall to rebut this 1500 - 3,000 watt evidence. I am sure he can.

Mr. Randall: Mr. President, our standard practice, and this practice has been in effect for 3 years now, has been to install a 750 watt heater. We started out by putting in 500 watt heaters, and we found that in general this was not sufficient. No water heaters are installed without lagging the tanks. A 750 watt heater in continuous service will supply the ordinary household, requirements with hot water service, or a 1,000 watt heater, with a double throw switch, so that it is cut out when the electric stove is in use, will supply the ordinary household requirements. Where the family is large, having a number of small children, or extraordinary requirements, it may be necessary to go to a 1,000 watt heater on continuous service, or a 1,500 watt heater used with double-throw switch as above.

Mr. Gould: I stick to what I said. We had one case of a barber shop where we put in a 1,500 watt heater, and the man could not get enough hot water to supply his customers. He reverted to a jacket stove with a coil in it. We had another case where a railroad man, who had his own apartments with bath, and wanted to use a good deal of water, and he wanted it hot. We put in a 1,500 watt heater, and it would not heat quickly enough. It would heat if you left it long enough, but it took too long to get results. We removed the 1,500 watt heater and he installed in its place a gasoline heater. This exploded one day and nearly burned his face off, and he came back to us. We then installed a 3,000 watt heater and he has had satisfaction ever since. I do not think the 500 watt heater would be of any use in those cases.

Mr. Randall: I can see the difficulty experienced in the above case and it brings up another point. Water heating is simply a matter of kw.h. It has nothing to do with kilowatts. It takes a certain definite number of kw.h. to heat a certain definite quantity of water to a certain temperature. If we supply, say, 500 or 1,000 kw.h. per month under a demand of 1 kw. or less we might be able to supply that service for, say, $[illegible] a month. If we supplied the same number of kw.h. at a demand of 10 kw., we certainly could not supply it for

$3 a month. Because in one case you have a demand of 1 kw., and in the other case a demand of 10 k.w. In the Power Sales Report you will notice it is stated that practically all companies are selling water heating service on the flat rate. If you will go back and install a 1,000 watt heater and let it run continuously in your house, I think next year you will come back and say that it worked, but lag your tank.

Mr. Dion: Mr. Randall stated that the average load was 1 kw.

Mr. Randall: 1 h.p.

Mr. Dion: That is due to the diversity factor.

Mr. Randall: Yes.

Mr. Dion: How much is it due to that ?

Mr. Randall: An individual range of the present commercial sizes will probably show a maximum demand of probably 3 kw.

Mr. Dion: That is average ?

Mr. Randall: Yes.

Mr. Dion. That is reduced to 1 h.p.?

Mr. Randall: Yes. Take for example, in one particular town we have installed a range capacity of about 1,000 h.p. In that town we have power feeders separated from the lighting feeders. Except under particular cases and except at the noon period it is difficult to find the effect of the range load on the load curve. It simmers down to somewhere around 20 per cent. of the connected load.

Mr. Volkman: Just a couple of points I would like to mention —one brought to my mind by paper on Commercial Light and Power Sales, on page 63, I believe, a question brought out was that the central stations have kept in close touch with the manufacturer of ranges, and that the manufacturer of ranges have followed very closely the suggestions of the Central Station. It has been my experience that the operating companies do not call the manufacturers' attention to the small difficulties they have with apparatus, particularly station and line apparatus. There are often small details in the apparatus that could be readily changed by the manufacturers if they knew about it. And I think this is a point that the operating companies should keep well in mind, let the manufacturers of all kinds of electrical apparatus know all the troubles that occur with their products.

In connection with hot water heating, a point which is of vital importance has not been brought out and that is of leaky taps. You have to have your taps tight if you want to have satisfactory service from electric water heaters.

Now, about Mr. Speer's question of providing clean air for generator cooling, the only methods are to build ducts to a spot where clean air can be obtained or to wash their air by taking it through one of the air conditioning systems at present in use. I do not

know of any companies that have it in use in Canada. Under ordinary operating conditions the only way to keep machines clean is by giving them continuous attention. In our operating department we have found that by laying out the cleaning of the apparatus to the various shifts—that is, each shift is responsible for the cleaning of certain particular pieces of apparatus. In this way every piece of station apparatus is cleaned periodically and all cleanings must be logged. Since we have adopted this system I can say that we have been practically free from failures to apparatus in our sub-station equipment.

Another point brought up by Randall in connection with the operation of small capacity plants and large capacity plants in parallel. I know of one case in which just the opposite of the point he brought up is true. I might state that it is in our own case, the operation of about 50,000 h.p. from our water power plant in parallel with a 15,000 kv-a. steam station. But in this case the steam station takes all fluctuations.

Mr. Davies: I can state from experience that the big plant sets the speed.

Mr. Speers: We are also looking for an accurate power factor meter and in this connection I might ask what method of determining power factor is being used by the Hydro-Electric Power Commission.

Mr. Davies: They use two meters to determine the kv-a and then the power factor as shown by the diagram Fig. 4.

Mr. Gould: I have a small plant and recently made a contract with the Hydro-electric Commission for a long term of years, and they have installed two meters after the method of Fig. 4. What I want to know, is this method of recording fair to the seller? In this case I am the seller.

Mr. Davies: That is the most accurate system in America.

Mr. Volkman: They have a meter on the market at the present time known as R. V. A. meter.

Mr. Speers: Is it made by the Westinghouse ?

Mr. Volkman: I do not recall whether this was made by Westinghouse or General Electric. It is a watt meter connected in such a way that it shows the kv-a and the operator goes according to that. For operating purposes, power factor meters are fairly accurate from 80 per cent. to 100 per cent. lagging or leading on balanced loads.

Mr. Davies: What power factor have you to carry there ?

Mr. Speers: 85 per cent.

Mr. Davies: You ought to get an indicating meter which with the watt meter would be alright.

Mr. Speers: The meter should be recording to be of any use in this case.

The President: If there is no more discussion, I wish to thank the Committees for their work, and the members for their able discussion of the papers.

Some things have been said about the Hydro-electric Commission—(Laughter)—and I would like to point out that some time ago the Chairman, who is imbued with the idea that he is a public benefactor, took the trouble to go to the United States and inform the members of a Congressional Committee on Water Power Regulations all about the Hydro, and in that speech, which was made on the 15th of April last, he made a good many remarks and statements which were very misleading, to say the least. You will probably have noticed in his reports, in almost every year, he draws comparison between the present hydro rates and former rates and states that the annual saving due to the Hydro Commission is so much. I think when he wants to make that report up he has a pipe dream and works up a fanciful figure. I think he has it up to something like $2,500,000 a year that he saves now. That, of course, is based, as near as I can tell, on the existing rates in, say, 1910—possibly before that. Those rates which form the basis of comparison are largely steam rates. The rates in Toronto, for instance, were entirely steam rates, the average house rate being about 8c a kw. hour. In the case of Toronto they had hydraulic power there—not for their full distribution on account of lack of delivery of transformers and other things, but knowing that Hydro was on the way, and knowing that they were going to deliver power at cost, they maintained their rates until the Hydro arrived, which was some two years after the hydraulic power was first delivered by the private company. Therefore this comparison of rates made by Sir Adam Beck is entirely wrong. If you were to take the Chicago rates, compare present rates with the 1910 rates, that is prior to war conditions, you would find possibly an equal reduction, in addition to which the Chicago Company pays taxes. Now, the tax item is a very large one. As I said in my report, Sir Adam stated in Washington that they had spent $70,000,000 on the Hydro and its distribution systems, without taking into account the Ontario Power Company purchase or the present hydraulic development. When you consider that the taxes on that investment, at anything like assessed value, fair assessed value, would be, say, a million and a half dollars a year, he has got to have some pipe dream to compensate that loss to the community.

Now, in Toronto, he has just published a statement in last night's papers—this, I think, is the 21st of June—a statement for the year 1917 appeared last night for the Toronto Hydro System. In this statement he states that the net profit, after paying operating charges, interest, depreciation, is $34,000. He states that there is over $10,000,000 invested in the Toronto system. Now, the tax rate

in Toronto is 30 mills this year, without local improvements. That would be a tax of $300,000 on assessed value of $10,000,000. Therefore his $34,000 profit looks pretty small. We could go on and analyse the system in that way ad infinitum, but it would profit nothing at all, no matter what criticism you brought to bear.

We have enjoyed this discussion very much, and I am sure we have all profited from the Reports. I hope that these Reports, which are multigraphed, will be taken home and distributed to other members who are not fortunate enough to be here, so that the results will not be confined merely to the small number present.

I believe it would be very profitable for some of these company sections to discuss these papers, and therefore propagate the information they contain, which has been obtained with some trouble.

If there are no further matters to come before this open meeting—

Mr Randall: I would just like to bring up one more thing about the Hydro, as everything seems to be against it this afternoon—in connection with your remarks—that we can take a leaf out of the Hydro book. They do not do everything on the wrong side of the sheet. For example, they are the most clever people I know of for getting more dollars per capita out of a town than we can get by any manner of means. If you go over the statements of the Hydro, which are very easy to obtain, and compare them with your own towns you will be astounded at the dollars per capita gross income that these municipal distribution systems get. It is amazing. And when Sir Adam says that he has saved so many millions of dollars by this comparison of rates that he has, I do not feel that it is a fair comparison, because those same towns are paying more money for electric lighting service in dollars per year than they would otherwise be paying

Proceedings of

Annual Convention

27th Year

of the

Canadian Electrical Association

Held at Montreal, Que.
June 7th and 8th
1917

Office of the Association
910 Excelsior Life Building
Toronto, Ontario

Canadian Electrical Association

Officers—1917-18

PRESIDENT:
D. H. McDougall,
Toronto Electric Light Company, Toronto, Ont.

FIRST VICE-PRESIDENT:
J. S. Norris,
Civic Investment & Industrial Company, Montreal, Que.

SECOND VICE-PRESIDENT:
E. A. Dunlop, M.P.P.
Pembroke Electric Light Company, Pembroke, Ont.

THIRD VICE-PRESIDENT:
A. Monro Grier, K.C.
Canadian Niagara Power Company, Niagara Falls, Ont.

HONORARY SECRETARY:
T. S. Young,
347 Adelaide Street West, Toronto, Ont.

SECRETARY-TREASURER
Alan Sullivan,
Excelsior Life Building, Toronto, Ont.

ADVISORY COMMITTEE:
Composed of Past Presidents Eligible for Office.

MANAGING COMMITTEE

P. T. DAVIES,
Southern Canada Power Company, Montreal, Que.

M. C. GILMAN,
Toronto Electric Light Company, Toronto, Ont.

J. S. GOULD,
Citizens' Electric Light Company, Limited, Smith's Falls, Ont.

H. M. HOPPER,
The St. John Railway Company, St. John, N.B.

E. L. MILLIKEN,
Cape Breton Electric Company, Sydney, N.S.

L. PRATT,
Dominion Power & Transmission Company, Hamilton, Ont

J. B. WOODYATT,
Southern Canada Power Company, Montreal, Que.

W. H. McINTYRE,
Ottawa Electric Company, Ottawa, Ont.

R. J. BEAUMONT,
Shawinigan Water & Power Company, Montreal, Que.

A. P. DODDRIDGE,
Quebec Railway, Light, Heat & Power Company, Quebec City, Que

H. E. RANDALL,
Shawinigan Water & Power Company, Montreal, Que

C. S. BAGG,
Civic Investment & Industrial Company, Montreal, Que

THE PRESIDENT,
National Electric Light Association, New York.

CONTENTS

PROCEEDINGS

In accordance with the decision of the managing committee of the Canadian Electrical Association, the convention held at the Ritz-Carlton Hotel, Montreal, on June 7 and 8 was of a distinctly business character. The attendance was large, the reports and papers of a technical and practical character, dealing with various phases of the association's work, and the discussions complete and of great value in elucidating many points raised in the reports and papers. The only departure from the strictly business programme was an informal dinner tendered by the members of the Montreal companies section, who gave the visitors a more than cordial greeting.

The President took the chair at 10 a.m., June 7:

The President: With your permission I will call this meeting to order. The first item on the programme is the President's address.

President McDougall's Address

This is the twenty-seventh annual convention of the Canadian Electrical Association.

The electrical or central station industry in Canada has just passed through perhaps the most eventful year since the founding of the first company in 1884.

The conditions imposed on our companies by the war have required resource, courage, and ingenuity as never before.

The demands for current have in most cases been abnormal, due to munition manufacture, and from the fact that Canada herself is prosperous; and these conditions have been met by the companies, for the most part, in spite of the extraordinary difficulties of financing, in spite of the inroads on our staffs made through our best men enlishing, due to the voluntary system we have been following, and in spite of the great difficulties many of our member companies have experienced in securing an adequate supply of coal.

In regard to financing, our usual market for selling our securities —namely, the London market—has, of necessity, been closed to us.

For a time the United States markets were of great assistance, but later, when it became apparent that America herself was likely to answer freedom's call and take up with us the task of restoring peace to the world, which involves the suppression of the autocracy which seeks to dominate us, all these markets apparently become more difficult to secure aid from.

It has become evident to many of us that we must be prepared to temporarily forego any extensive financing, and must limit our

capital requirements to items of a most imperative nature, and which can be financed among our own shareholders, or in the Canadian money markets.

Many Employees Answer the Call

The central station companies, through their employees, have demonstrated in no uncertain way their loyalty and love of freedom in the ready response made in answering the voluntary call for service in the wider field offered by the call to arms. From every quarter it will be found that the percentage of men enlisted from the central station employees is nearly double that of the percentage of enlistment from the general localities of the various companies.

Here in Montreal I am informed that about 35 per cent. of the normal number of men employed have enlisted, and in Toronto about the same ratio obtains, both from the private and the municipal organization.

While this is what we would expect, as we are aware of the spirit of esprit de corps which has prevailed among our employees, especially when we remember that "service" is always the slogan which we endeavor to preach to our men, still the demands made upon our service to our customers has caused our department heads many anxious thoughts, and I think I can safely say that from our experience we, one and all, will agree that if Canada had adopted selective conscription from the start, many of our highly-trained and dependable men would have been spared to help us share the responsibilities which the war has imposed on us, and that many of these men would have rendered at least as effective service to the cause had they remained at home. We congratulate our friends of the National Electric Light Association on the decision of the American authorities on the methods of recruiting adopted by their government. We feel sure it will spare them from many of the worries we have suffered.

The supply of coal has been another source of worry to some of our member companies who are dependent on steam generation, conditions due largely to car shortage, brought about, I am informed, through lack of ocean bottoms and consequent freight congestion at the gateways of ocean transport.

I have every reason to believe that we can look for no improvement during the coming winter, and would urge the companies who require coal to use every possible effort to provide themselves with a large reserve during the summer months if they can secure it.

Unfair Comparison

A large number of our members have been further embarassed by the wave of municipal ownership that is now prevailing in Canada. It has recently made its appearance in British Columbia and else-

where, and the experience in some quarters of inadequate service, service such as no private company in Canada was ever guilty of, does not seem as yet to have been sufficient to cause our worthy municipal authorities to pause. The advocates of municipal ownership point to the large savings that have been affected in Ontario, and draw comparisons to prove their claim to the difference between rates now charged compared with rates charged in 1910, or seven years ago, when hydraulic power was in its infancy and rates were based on old and inefficient steam-generating units. They overlook the fact that in cities like Chicago, where modern methods have been used, an equal reduction has taken place without the necessity of pledging the municipal credit for a much inferior service.

Our membership, as will be shown by the secretary's report, shows the association to be in a flourishing condition, and our finances, I am pleased to say, are in better shape than they have been for some years.

In closing, I desire to inform you that a singular honor has been conferred on the association by the election of your President to the position of vice-president of the National Electric Light Association. This compliment was conferred on the Canadian association, and is to be taken as an evidence of our allies' desire to further the friendly feeling that has always existed between us.

Your committees have been energetic during the year, and have provided interesting and instructive reports, which I trust will provoke instructive discussion during our season. The thanks of the association are due to them, and also to the members of your executive committee, who have been active in your interests during the year.

I will call on the Secretary to read any general correspondence.

The Secretary: There are only two or three letters here —one from Mr. Wagner, President of the National Electric Light Association. Letter read.

The President: Gentlemen, it is with great pleasure that I announce the next number. The National Electric Light Association, as you know, is a similar association in the United States affiliated with us, and we have—I say it with some knowledge—we have derived a great deal of benefit from this affiliation. The reason we have not derived more benefit is our own fault in that we have not used the available material.

Mr. Muldaur is the Traveling Secretary of the National Electric Light Association and has been doing some missionary work in connection with the organization of Sections. Some of you here belonging to the Montreal Section will remember his very inspiring talk which he gave the Section here a little while ago. He has done work in Canada and with very good results. Mr.. Muldaur has just finished a tour of the United States and Canada in the interests of the Asso-

ciation, and his work has been a great incentive to the Central Station men, and we are glad that the Association chose him as their representative to our Convention.

I have much pleasure in introducing Mr. Muldaur.

Mr. Muldaur: Mr. President and Gentlemen, your President has taken a little of the wind out of my sails, for I had hoped to convey Mr. Wagner's and Mr. Martin's greetings to you verbally. I can only add to what they have written, that they both asked me to congratulate you on one more good year spent, and to give you their personal regards; Mr. Martin sent his to all of his personal friends in Canada—I don't know of any place on this earth where Mr. Martin has not got personal friends.

We have rather reversed the order of things I believe in the last year or more, in that the National Association, being the largest organization of the kind in the world, is following, rather than leading, the Canadian Association. This condition, the war, that we have now gotten into, has simply knocked everything into a cocked hat so far as our preconceived ideas were concerned, and our placid way of going along. We have suddenly been confronted with the necessity of taking a new course of action. Our Convention this year was modelled very largely on yours of last year, and was just about what this is now. It was not actually a convention—it was a conference. There were no papers read. Everything was submitted by title, no reports even were read, but the entire organization devoted itself solely to carrying out the plan that has now been adopted by all of the public service associations, I believe without exception, to co-operate most effectively and most immediately with the Government in doing its bit.

I cannot help a feeling of pride, although it is not unexpected, in the splendid result of the registration for our selective draft. When you think of ten million young men—(applause)—and it is especially gratifying to those of us (and I think that represents nearly all of us) who have chafed under the necessity of staying out of this so long. Now that we are here I believe we are doing everything that can be done to get in shape quickly. Before this registration took place several of us were speaking together and there was not a man present who could think at the moment of a personal friend or acquaintance who had not himself, if he was of age, or through some member of his family, already gotten into the service. Nobody worth while in the United States waited for this draft, and enormous numbers, hundreds of thousands of these boys who were drafted, had already made application for service. You know the draft took in everybody, no matter whether in service or not. I think we may be looked upon as real allies in fact as well as in name, from now on. (Applause.)

There is one thing that you can help us in tremendously. Your experience in the last three years is such that we have got to come and borrow from you. In the last Convention we had there was nothing more inspiring and significant than the two short addresses by Mr. McDougall and Mr. Aldred showing what you have done here, the conditions that you had confronting you and the way you have solved problems that we are just beginning to solve. And we know, of course, that we shall have every bit of help that you can give us. And we need it. God knows, we need it!

The National Association has for its first wish to be of the greatest possible value to all of its members and to all of its allied and affiliated Associations. During the past year in carrying out a policy that has been adopted recently we have formed two new departments. One of them Mr. McDougall has very kindly referred to, that of the field work for the purpose of keeping in very close touch not only with affiliated and geographic sections, but with the actual individual member.

This trip that I have just completed has taken me into nearly every State in the Union and British Columbia and the two Eastern Provinces of Canada. During that trip I visited some 75 cities, so that it took in almost all of the important companies, and really gave us a personal feeling of relationship that could not be got by any possible amount of correspondence. The system has proved itself very successful and we are going to push it more intensively in the coming year.

The other department, one of very great value, is that headed by Mr. W. C. Anderson, the Department of Statistics. The National Association has always had a mass of experience and information in its archives, but it has been a more or less dignified old body, and it has not advertised the fact that it had this stuff nearly as much as it should. Other associations have popped up from time to time and said they were the only ones that could give information that the people in the field required. We do not believe that is so. We do not think there is a single question that can be asked, a single problem that can be brought up in the electric light and power field that cannot be helped, and in most cases not only answered but solved, through the experience of the Association. And now the information is gathered into a card file, cross indexed, so that it is instantly available to the largest or smallest member of the Association at all times. I believe you will find that this Department of Mr. Anderson's is going to be one of the most valuable things that the Association has ever started.

One of the bits of constructive work that has been very actively pushed this year is that of the Company Sections; educational work. Mr. Wagner is peculiarly interested in that work, and naturally so.

due to the tremendous success of the Section in his own Company the Consolidated Gas, Electric Light & Power Co., of Baltimore. We feel, and it may be a truism, that sometimes we lose sight of the fact that the most valuable bit of mechanism any organization has in its possession is the man, not the machine. Mr. Wagner is of the opinion that the greater amount of work spent on developing the individual in any corporation the greater value will result to the concern.

The Company Section idea was a growth, and a great many mistakes have been made. And a good many of the perfections that I speak about have been the result of trial and almost despair sometimes. Some of the older Sections fell out altogether; disappeared. And even now there are some more or less in disuse because of a lack of understanding as to the impossibility of interesting everybody in the Section in the same subject. You can naturally see that that is utterly impossible. A number of Sections have started by having meetings at which some highly technical address was made, which interested intensely one-quarter of the men at the meeting, and put the other three-quarters to sleep. That did not do, and after a few of these meetings these Sections calmly died.

I have been instrumental on this latest trip of bringing into life and real activity no fewer than nine such Sections. They had not done any work for a good while because they actually did not know how to do it. We have also established 16 new ones, and now have 64 sections.

I want to say a few words about that Section work. I want to say that even where a company is so small that there are not members enough to form a real Section and go ahead on the Section plan and idea, there is no earthly reason why educational work should not be kept up. Our Association is publishing now correspondence courses at a purely nominal price—the charge, I think, is $12 a year for most of them, which would compare with the International Correspondence School, Hamilton Institute, and that sort of thing—at about 10 per cent., may be a little more, 15 or 20 per cent.; but the charges are nominal. Engineering courses and accounting courses are so far available, and others are now in preparation. These courses are now purchasable only by members of the Association. Until now they have been public, but from the very nature of things, getting them at such a very low cost, the Executive Committee thought best to limit the use of these papers to members of the Association, and that will be done in the future. So these classes can be carried on, and are carried on, by a number of the smaller companies just as though they had good-sized, live Sections.

Just a word or two about the organization and operation of the Sections. The most successful ones find that they get the best re-

sults by having a "get-together" meeting about once a month, and in some cases less often than that. At that meeting they have a programme of general interest; nothing too technical and nothing very high-brow. A speech or a paper by some local celebrity or someone who can get the attention and hold the interest of the entire body of the members present should take up about half or three-quarters of an hour—three-quarters of an hour at the outside; not enough to bore anybody. Then the programme to be interspersed with recitations, readings, songs, and music. There are a number of Sections that have bands and orchestras; there are very good string archestras in some Sections in the States. Wrestling and boxing bouts—anything that will keep men together. And on one or two occasions during the year it is a good thing to have the programme so arranged that ladies also can be present. Getting the wives and families of the members around tends to bring them closer together. The sole idea of this getting together of the men is not in the least educational; it is purely for this purpose—to get the rough edges rubbed off. In a large organization it is almost impossible to prevent a certain amount of misunderstanding; a certain amount even of jealousy between departments and between individuals. The Section is designed to bring the men closer together, to get real co-operation, to make the men understand that they are all working towards the same end; that the salesman is no more important than the meter reader, and that the engineer cannot do his work properly unless the whole machinery of the organization works well, right down to the stoker. To find out what a man is doing, to see where his bit works in with yours, where all machinery is co-ordinated, there is no better way than to have something that takes you out of yourself, out of your actual work and brings you in close personal contact with these men. Much more of this can be done about a little round table swapping stories than by burning midnight oil in study. Then the educational work is done in a totally different way; that is, taken up in groups at first along the lines of the National Section hand books. There is the salesman's handbook, meterman's handbook, construction handbook and accounting handbook. One of these is sent gratis to each member of the Association, and we find in forming Sections it is an excellent plan to form the educational groups along these lines, using these books as text books. Then as they go on the groups are divided and sub-divided. The Commonwealth Edison Company in Chicago has something like 125 groups. The study is done at home—just as the old school work used to be —and the men get together under their group leaders once or twice a week, go over the matter in hand and have their recitations or quizzes or simply discussions. Now, of course, I am speaking of the larger companies. You can see readily how the plan may be

worked out in the smaller companies. I have in mind a little company of 19 members only that gets absolutely no help from its officials. The officials are old-fashioned chaps who feel that the men are drawing their salaries to work, and they are not interested at all in what they do for themselves. It is a case almost unique in my experience but it is a fact. These old fellows will die one day and then things won't be so dead. Meantime those boys are pulling themselves up by their own boot straps. In this little Section of 19 men they now have three groups. The first time I visited them they were trying to interest all those men, from salesmen to linemen, in a single subject, but when the group work was explained to them they simply ate it up, and they are going ahead exceedingly well and will produce very good results indeed.

Just one more word, as to the financing of these educational courses and the work itself. It is sometimes advisable to have small dues in the Section itself in addition to the Class B dues that the Association receives. By the way, the Association gets nothing whatsoever from the Company Sections as such, but the members of the Sections are supposed to be Class B members of the Association. A good many of the companies pay half of those dues for the men, and in that case the other half frequently goes into the Section treasury. A good many of the companies pay quite a large amount for sectional activities, some Sections several thousand dollars a year, and some do not find it necessary to pay any when the section is very small. But as to the financing of the courses, we find nearly all companies very glad indeed to pay the expense, whether they be the educational courses that the Association sends out, the correspondence school courses from such institutions as the International Correspondence School or Alexander Hamilton Institute, or whether they be University Extension courses or lectures and recitations that a man can attend in his own town when there is a local University or College. Companies will pay that and take it out of the man's pay so that at the end of the course the whole thing is paid up. There is no feeling of charity; the man knows more and the company has the use of his increased knowledge, so that everybody gains and nobody loses.

This Company Section work is inspiring, and having had the privilege of seeing so many of the sections grow up and so many of them improve under a little stimulus, I know that it is tremendously worth while, and I hope you will consider very carefully the formation of Sections in all of your companies that have not already got them. I cannot speak too highly of the tremendous enthusiasm that I found here in a little trip I made three or four weeks ago. I attended four of your Sections, and we established two new ones and built up one which was a little bit in disuse on account of some lack of under-

standing about group work. We found that the men were only too eager and anxious to get to work, and it only requires a little bit of stimulus from the executive of a company itself to make better men of them for all time.

That is all. I am not going to take any more of your time, except to say that the National Association, in addition to being always ready to be of every service at all times, appreciates intensely your attitude, your loyalty and the feeling which I know, and we all know, you have toward us. It congratulates you on your past work and it wishes you all Godspeed for the future.

The President: On your behalf, gentlemen, I wish to thank Mr. Muldaur for coming here and giving us this inspiring talk, and we trust that he will stay throughout our Session and aid us with his large knowledge of things electrically in the discussions.

I will now call upon Mr. Maclachlan, Chairman of the Committee on Accident Prevention, to read the Committee's Report.

Mr. Maclachlan has done a vast amount of safety work during the year and his Committee, which has met several times, has taken some pains with this Report, and it is a subject that we can all very well afford to pay a great deal of attention to.

During the reading of the Report you might take notes on anything that you think should be discussed or enlarged upon, and we hope that it will provoke an animated discussion.

Report of the Accident Prevention Committee of Canadian Electrical Association, Year 1916-17

Toronto, May 11, 1917.

Your Committee on Accident Prevention was appointed by the President on October 18th, 1916, and since that time has held meetings and has carried on a considerable amount of work by correspondence. The question of accident prevention has been considered by this Association for some years, as the Association no doubt realized that it was an extremely important phase of central station practice. In the United States a number of the chief executives of the various electrical companies are giving this work their very close consideration, and it is certainly reasonable to expect that men in similar positions in Canada should take a similar view. One of the difficulties that an employee of an electrical concern is labouring under is his inability to secure insurance at a reasonable rate, the insurance companies claiming that the electrical industry is an extremely hazardous one. It is certainly just that the Association representing the electrical industry should investigate ways and means whereby the industry can be made less hazardous so that our employees will not be confronted with such difficulties.

The owner or chief executive of a power company should investigate what accidents mean to his company. At the time of an accident there is the danger of damage to expensive machinery, the upsetting of an organization that has taken years and a great deal of money to bring up to its present state of efficiency, there is the danger of injury to the public as well as the possibility of a shut-down, and these all in addition to the cost of the damages or compensation that have to be paid to the injured man. Your Committee well realizes that in the smaller companies and in some of the large ones an accident is a very unusual occurrence, yet when it does happen it often costs a man his life and stigmatizes the electrical industry as a very dangerous occupation. Is it not worth while to spend a little of your time and money regularly to try to prevent these accidents instead of merely insuring your men and paying them or their dependents something in compensation? By this we do not mean to start up a quick, large, active campaign and let it die out in two or three months, but to keep everlastingly at it until success crowns your actions.

The company and employer may be enthusiastic for the prevention of accidents, but if the superintendent and foreman are not whole-heartedly interested in the work the whole effort to a large extent will be wasted. These men are the instructors of the rank and file of the electrical industry. They are the ones who come intimately day by day in touch with the work that is being carried on, and they, above all others, are able to make the work of accident prevention a success or a failure. Their opportunity for assisting in this work is very large and just as large is their responsibility. The foreman or superintendent who has an accident in his gang or department should be held strictly responsible for the accident. He knows how the work should be carried out and is in a position to see that the men under him are correctly instructed and are competent to carry out the work in a safe and efficient manner.

The man on the job, however, has an extremely important part to play in accident prevention. The employer is interested from a purely financial or a sentimental or broad economic viewpoint. The foreman or superintendent is interested because it puts him in bad odour with those in authority and also because of his feeling for the man that is injured. But the workman looks at it, or should look at it, from an entirely different viewpoint. If there is an accident he will have a lot of physical suffering, and there is a likelihood of his receiving an injury that will maim him permanently. The dependents of most workmen are totally dependent upon his ability to bring in the monthly wage. Should he not be interested in anything that is going to insure his ability to be able to bring in that wage as long as he lives, and until his family are grown up to such an age when

they are self-dependent? In analyzing accidents we are struck with the repetition of the reason given for the accident—"I forgot." Forgetting may be alright in some industries, but it is sheer suicide in the work of an electric power company. Real accident prevention can only be carried out by the hearty co-operation of the employer, the foreman and the workman; where you have these three working together toward the one aim of preventing accidents, you have very successful results in accident prevention.

For the last two years the chairman of this committee has had the honour and pleasure of representing the Canadian Electrical Association on the Accident Prevention Committee of the N. E. L. A. This is the connecting link, as far as accident prevention is concerned, between the work of the Canadian Electrical Association and the N. E. L. A. It has been of considerable assistance in our work to have the opportunity of viewing the broader field of accident prevention as carried out in the member companies of the N. E. L. A. It has also been of considerable assistance in preventing any overlapping between the work of these Associations. Those members of this Association who have had the honour of working on committees of the N. E. L. A. will readily see the great assistance that this connection has afforded, and we wish here to publicly thank the chairman and members of the Accident Prevention Committee of the N. E. L. A. for their great assistance and co-operation during the past two years.

Your committee has carefully considered methods of organization for accident prevention and has come to the conclusion that the method as outlined in Appendix "D" of the Report of the Accident Prevention Committee of the N. E. L. A. presented at Chicago in 1916 is the most practical and satisfactory method of carrying out this work. In brief, the method is as follows:

The President of the company should hold a meeting at which the chief executive officers are in attendance and should explain to them the resolution of the company to actively engage in accident prevention work. This is one of the most important steps, because without the hearty co-operation of the heads of the departments any work in accident prevention will be extremely slow. A careful examination of the physical plant should then be made and all hazardous conditions rectified. It is useless to ask employees to assist in preventing accidents unless the employer can show in some physical way that he is in earnest in trying to carry out this work. A central committee to have charge of accident prevention should then be formed, this to consist of the heads of those departments employing the most of the workmen. If necessary an intermediate committee or committees should be formed in departments. Employees' organizations should then be formed to give an opportunity for the

employees to discuss ways and means for the prevention of accidents. The recommendations of these employees' organizations are then forwarded to the accident prevention committees for action. As will be realized, this work will not run itself. When a piece of construction work or a sales campaign is undertaken, it is made the duty of some one individual, similarly the work of accident prevention should be made the duty of some official of the organization. This is the plan of organization in brief, and it would be to the interest and advantage of all members of this Association to carefully read and analyze the plan as given in full in the above mentioned report.

From time to time various safety devices are presented to the Accident Prevention Committee of the N. E. L. A. These devices are such as have been successful in the work in the various companies. A station foreman in one company may work out a good way of protecting a certain standard piece of apparatus. Would it not be of assistance to the industry in general if this information was distributed? As a means of starting this work in the Canadian Electrical Association, a letter was sent to all member companies asking for their co-operation and help. We are extremely sorry to report that up to date we have received no replies.

Some of the matters brought before the N. E. L. A. Committee are as follows:

A lineman's insulating shoe arranged with a white rubber sole of good wearing material, inside of which is a red insulating piece of rubber, and when the white rubber wears through, the red rubber shows, giving an indication of danger. This shoe is found to be very adaptable to the work of lamp trimmers and would well warrant investigation by companies who are employing this type of man.

Goggles.—A special form of goggle has been developed for use around electrical apparatus. This goggle is non-conducting and non-inflammable, and fitted with the correct type of glass a great number of the injuries due to flashing of eyes by an electric arc would be eliminated.

Arc Welder's Helmet.—The use of the electric arc in welding processes is becoming more and more general. A helmet has been designed formed of heavy fibre and open at the top. In the front of this helmet is inserted a round disc of the correct type of glass held in place by fibre washers and bolts. This helmet is found to be comfortable and gives the man ample protection.

Some other devices that have been presented are:—Insulating stools for station use, which will not tip over; danger sign caps for remote control switch buttons; fuse pullers with the handles made of red fibre, thus drawing attention to the place where the holder

should be held; wooden nozzle for hose to be used around high tension apparatus; specially designed lamp trimmer's ladder, so arranged that it will not slip and can also be used as an insulating stool.

This gives in a short way the type of some of the devices that are sent in by member companies of the N. E. L. A. We are certain that the C. E. A. member companies are just as alive to the necessity of devising appliances for accident prevention, and we would suggest that in future blue prints and descriptions of these devices be sent in to the Accident Prevention Committee, so that this information can be distributed among the member companies..

Belts and Spurs.—The practice in general in electrical companies is to require the linemen to supply their own belts and spurs. We recognize that there are serious difficulties in the way of arranging that the company supply these appliances as well as the other tools, but as a safety measure it would be found of considerable assistance if the company could see its way clear to arrange for the supplying of all belts and spurs. Standard practice in regard to a lineman's belt points now to the use of the best harness leather, well sewed and riveted, the hardware of the belt should be either drop forging or bronzed, it being found that the D's of the belt become crystallized and break. Belts should be carefully inspected at least once every two weeks by someone other than the lineman using it. In connection with spurs. In the Eastern part of Canada, the light spur or hook is most commonly used, but a dangerous feature in connection with these is the upper strap upon which most of the strain is thrown; these straps should be carefully inspected, and when found in not first class condition should be discarded and renewed. The Western spur is used for the most part in Ontario and the Western Provinces; a dangerous point in connection with this appliance is the riveting of the sharp spur into the leg iron. Should this spur become loose, it should be immediately taken to a blacksmith and put in shape. Inspection and standardization of spurs and belts will go a long way in preventing line accidents. Most fatal accidents in line work are caused by the fall and not by electrocution, and this is principally due to the infernal habit of linemen refusing to use their safety belts.

Rubber Gloves.—In the Fall of 1915, the seriousness of the question of rubber gloves was brought to the attention of the Accident Prevention Committee of the N. E. L. A. Rubber gloves were being purchased by electrical companies, and in the majority of cases received absolutely no "acceptance" test; there was no such thing as a standard rubber glove and the whole question was found to be in a very deplorable condition. If an electrical company was guarding a priceless piece of machinery that could not be replaced.

is it not reasonable to expect that the guards used would receive most careful inspection and be put through a most rigid test? Linemen and operators are required to work on 2200 volt lines that are alive, and the only reason that they are able to do this work is because they wear rubber gloves and use the other necessary precautions. Having this in mind, should not the company and the employers be very inquisitive as to whether the rubber gloves are safe for the work in hand?

During the year 1915-16, a preliminary series of tests on rubber gloves were carried out and a progress report made to the Chicago Convention. During the year 1916-17 a more elaborate series of tests were carried out and it is found that more time is necessary before a definite report can be made. Some points, however, can be deducted from the work so far carried on. The standard rubber glove will be for work on lines the voltage of which to ground is not more than 3000 volts. The gloves are to be made by the dipping process and are to be vulcanized by some other method than the acid method. The gloves should be marked in such a way that they can be easily identified. They should be tested for acceptance by electrical and physical tests; the electrical test to include a voltage test and the finding of the leakage current. It might be of interest to know that the results of a test which has been put to a number of people holding a pair of pliers in one hand and having the other hand immersed in a can of water resulted in the person being able to stand 6.3 milli-amperes at 18 volts, 60 cycle current, and 6.8 milli-amperes at 23.5 volts. This is the result of a very carefully conducted test, and the figures are certainly astounding. Another point that has come out in examining the question of rubber gloves is the matter of the storage of the gloves; they should be kept in a temperature of 60 to 75 in a dark place, preferably each pair of gloves in a box by itself. The question of routine testing should be carefully considered. It is not enough that the gloves be inspected when they are first purchased, they should be tested and inspected regularly. If you have an important meter on your line do you inspect it when it is purchased, put it in position and forget about it? I think you will agree with me that it is very carefully checked from time to time. The records of each glove should be kept on a card, this card to show the date of purchase, firm from whom purchased, price, date of acceptance test, record of test and record of each routine test, with date.

Resuscitation. In the British Medical Journal, March 8th, 1913, you will find the following:—

> "The importance of getting to work with artificial respiration without a moment's delay has often been emphasized by

those who have had much experience in electrical accidents."

In the Journal of the American Medical Association, July 1st, 1916, you will find:—

> "Universal training in the Prone Pressure Manual Method of artificial respiration will accomplish more for resuscitation from drowning, electric shock and asphyxia than is possible by providing any amount of apparatus."

In the Report of the Accident Prevention Committee of the N. E. L. A., 1916, you will find:—

> "That in all cases of unconsciousness from electric shock, the Prone Pressure Method shall immediately be applied by persons instructed therein and that mechanical devices for artificial respiration shall be used only as auxiliaries, and then only by trained laymen or physicians."

Here we have the highest authority in the medical profession in England and the United States, together with a report of the N. E. L. A., impressing the necessity of immediate action in the case of electric shock and resuscitation by the Prone Pressure Method. Anyone who is interested in the subject can collect a considerable amount of evidence as to successful cases of resuscitation, and we feel sure that they will come to the one conclusion that is stated in the report of the N. E. L. A. Committee.

If resuscitation by the Prone Pressure Method is to be used, then careful training of all employees in this method must be entered into and constant practice therein maintained. We agree that it would be far easier and possibly cheaper to buy a piece of apparatus, install it at some convenient point and depend upon it to resuscitate men when they receive a shock, but we are forced to the conclusion after analyzing numerous cases of attempted and successful resuscitation from electric shock, that the only safe way of protecting employees from electrocution, is by a well-trained force in the Prone Pressure Method of Schaefer.

It is not the intention of the Committee to take up your time by citing cases of successful resuscitation, but the following is a fairly typical case. A man in a construction gang was left behind to finish some work outside a sub-station. He was warned not to do this work while the power was on. However, to save time he attempted to do the work and received a shock of 33,000 volts and dropped to the ground. The sub-station operator heard the flash and ran out and called for help. He immediately went to work on the man and started resuscitation. Two doctors came along and told him to stop work as he would certainly kill the injured man; he refused to do this and the doctors forcibly pulled him off his patient. He ordered them off the company's property and told them he was in charge of the

case and went back at his resuscitation. Shortly after, two other doctors came along, one of whom was the company's doctor. He immediately started in to help the operator, who, by this time, had the man partially breathing. The man was soon breathing and was removed to the hospital. Since that time he has fully recovered and is back on the job.

That is the result of well-trained employees in resuscitation. Far better results could be obtained if co-operation between the medical profession and the electrical profession could be instituted; each, we feel, has a great deal to learn from the other, and with this end in view your Committee has pleasure in moving—"That the Executive Committee of the Canadian Electrical Association is hereby instructed to get in touch with the officials of the medical profession in Canada and other interested electrical bodies and that a Commission be appointed representing these various bodies, and that it be instructed to investigate the mechanical and manual methods of resuscitation from electric shock and report as to what they consider to be the best method to use in the work of an electrical company."

Ground Chains and Clamps. Your Committee would like to hear discussed the relative merits of the protection of linemen by ground chains or by ground clamps. In Ontario recently, two men were killed on a 6600 volt line while they were working between a chain, shorting the line but not grounding it, and a sub-station. The switch in the sub-station was thrown in, one man receiving a shock and falling about 35 feet, the other man receiving a bad shock and burn, but not falling. It has been standard practice to use ground chains, but some of the companies are now discarding these and using grounding clamps. The subject is an important one, and we feel that much good could come from a discussion.

In closing, your Committee feels that it has done very little during the past year, matters having to do with assistance of technical men in carrying on the war making it impossible for the chairman of the Committee to devote very much time to the work. We feel, however, that the work of accident prevention should receive from year to year the careful consideration of this Association, and hope that a committee will be appointed to carry the work on during the season 1917-18.

Respectfully submitted,

(Signed) WILLS MACLACHLAN,

Chairman

Accident Prevention Committee C. E. A.

W. F. Burgess,	Montreal, Que.
Chas. H. Hutton,	Hamilton, Ont.
Geo. Kidd,	Vancouver, B.C.
J. T. Lambert,	Ottawa, Ont.
E. I. Milliken,	Sydney, N.S.
J. F. Neild,	Toronto, Ont.
Wills Maclachlan, Chairman,	Toronto, Ont.

The President: This is a very valuable Report. The Association and the individual members will do well to take it home and thoroughly digest every item. You cannot eliminate the human element in our work. As Mr. Muldaur stated, one of the best assets of the company is the well-trained man. You know, some of you that have the pleasure of signing your name to checks or bonds in large volume each day, that some time in the day possibly, no matter how clever you are, there will be a time when you will stop and you will probably look back at the last name to see what your name is. It is just a temporary aberration; that is what causes engineers of locomotives to run past a signal, they are so used to seeing them set right that they sometimes run past without thinking. It is the same way in this safety work, unless each man is educated and time given in the co-operation necessary, from the head of the company down, you are going to have an aggregation of men who are not educated along these lines, and, as Mr. Maclachlan very graphically illustrated, if you had a machine it would be inspected, but a man is allowed half the time to run along without this inspection, which is so necessary.

There is a danger, in this work of safety, of the men being suspicious that the company is going to get more out of it than the men themselves, that there is a nigger in the wood pile when they are asked to do things in the way of training and resuscitation and that sort of thing, and it is going to benefit the company more than the man. That has got to be a matter of education.

I would like to say that Mr. Maclachlan is an authority on safety work. Mr. Maclachlan is Inspector of the Electrical Employers' Association of Ontario, which is an association under the Workmen's Compensation Act of the Province. The electrical men come under one group of the Workmen's Compensation Act, and under the terms of the Act we are authorized to administer the safety work of the electrical group in Ontario. Mr. Maclachlan has been so successful in his educational work among the various members of the group that our rate of premium paid to the Government has been kept within bounds. While higher than formerly charged for protective insurance, that is nothing to reflect upon Mr. Maclachlan, because that is the Government's action. Mr. Maclachlan deserves the greatest credit for the fact that the new Act of the Workmen's Compensation Board of Ontario, recently passed, embraced first aid and hospital attendance to the men, and requires an additional premium from the companies to carry. Our group is the only group of all the groups in Ontario whose premium has not been increased. That is due to the results for the last two years and the small number of accidents we have had.

The Department Committees Mr. Maclachlan mentioned in his Report should be, in my opinion, emphasized. The men themselves,

unless they are ably led, and this work is followed up, will lapse into the old methods of haphazard. It is for the executive men in the companies to follow this work closely, not only for their own good, which is quite evident—the loss of men is a reflection on the industry—but also from the human side of it, that they are interested in their employees above all. This is nothing more than co-operation.

There is a motion included in this Report; I presume it is before the House. It is a motion of the Committee—with your consent we will not consider that motion until the Class A meeting. It seems to me that is a matter for the Class A members to deal with.

The paper is now open for discussion. I hope there will be a good deal of it.

Mr. P. T. Davies, Montreal: There are one or two things in the Report I would like to have a little information about, and the first thing is in connection with rubber gloves. Our standard practice is to protect the rubber glove with covers in all cases. I do not see that there is any mention made of the use of covers or the inspection of covers in that connection. We use a cover made out of some sort of buckskin, I think.

The second thing is in connection with medical inspection. I do not know whether the members generally know of the efforts being carried on in Montreal in line with the American efforts to choose the right man for the right job. The Rubber Company of Canada has a very excellent doctor, Dr. Mahaffy, who is very anxious to safeguard the men from themselves. To that end, every person who applies for a position in the company has to go through a medical examination as to his physical fitness for the work he may be able to do. That end of it seems to come within the range of this Committee.

The third point: I see no mention in resuscitation of the pulmotor or lung motor. We are rather interested in this matter, as we have been working pulmotors for a long time, and it is very doubtful as to whether we are getting very good results. The lung motor which has been developed is, as yet, I believe, not authorized or not standardized by the National Electrical Association for use. I would like to have some definite information on that, as from time to time we have salesmen coming around with the lung motor telling us that they have replaced about 5,000 pulmotors and the latter is no good. We do not buy any of them now because we have come to the point where we do not know what to do. I would like to have any information from those present who have used these two, if they have any success.

I must congratulate Mr. Maclachlan upon his Report; he has taken a lot of trouble and work.

The President: I will ask Mr. Maclachlan to reserve his replies to these questions until the close of the discussion.

Mr. Grier: As I may be obliged to leave shortly, I should like to say a word or two of a general character in regard to this exceedingly interesting and excellent Report.

I endorse very heartily, Mr. President, the comment which you made with reference to the opening remarks of Mr. Muldaur this morning. I should like to think it is not altogether unbecoming on my part to say this, that not only did the matter of the address impress me tremendously, but also the manner of it—that is to say, it is exceedingly delightful to find a subject, so interesting, dealt with so very admirably in language which made the address an exceedingly welcome one to listen to, and one which made us all the more charmed to have Mr. Muldaur with us this morning. His language enabled us better than ever to realize that fine significant circumstance, so present to all our minds, that we are real, actual allies of the United States in the great war.

With regard to this Report, I do not wish to impinge at all upon the practical points, which doubtless will be dealt with by various members of the Association here. Might I ask, Sir, if it is intended to put the document into more permanent form, that is to say, printed form, at any time?

The President: That is a matter for the Class A members. There is no present intention.

Mr. Grier: As I may not be here tomorrow, and assuming such a thing as the printing of the Report to take place, I should like to suggest to Mr. Maclachlan—whom I also wish to congratulate very heartily on this Report—that perhaps it would be well to transpose the concluding paragraph which deals with the subject of "Ground Chains and Clamps," placing it immediately after the other sections which deal with particular portions of the operations, as it were, of the plant, and to make the other item of the Report, viz., "Resuscitation," form the concluding portion of the Report.

There is just one other observation which, perhaps, in my case, it is not out of place to advert to. I see that it is stated at the top of page 2 that the foreman or superintendent should be held strictly responsible for the accident. I do not wish to throw into the cockpit, as it were, any such dangerous and unpleasant thing as a discussion of law; but I am at present of the view that it would be wiser or more correct to state, not that the foreman or superintendent is strictly responsible for the accident, but that he is strictly responsible to account satisfactorily for the accident. In other words, what is present to my mind is this: That accepting, as I do, absolutely the general statement as to the obligation to instruct the men, and so on, yet, despite the carrying out of these things quite perfectly,

arising from the fact that there are weaknesses in human minds, you might have accidents even in the case of well-trained employees, due to some temporary weakness. In such an event, it occurs to me that it would not be fair to charge a foreman or superintendent with being responsible for the accident, but in that case, as in all others, it is fair that he be held strictly responsible to account satisfactorily for the accident.

The President: I should suggest that you might move an amendment to the report and put the word "accountable" instead of "responsible."

Mr. Grier: Perhaps that would be better. I was going to say generally, that there are a few trifling things in the Report which occurred to me as susceptible of slight revision; I mean in the matter of verbiage, and, if agreeable to Mr. Maclachlan, I am quite at his service to go over it with him.

I wish to say in sitting down that I am quite impressed with the interesting character of the Report, and also with its very great importance, and I feel quite sure that out of it, and out of the discussion following upon it, great good will result to the Association.

The President: Any further discussion?

Mr. Williams, Montreal: I see here, "As a means of starting this work in Canada a letter was sent out to all member companies asking co-operation, and that up to date we have received no replies." I don't just know exactly how the companies have handled that. I suppose the letters go through in the usual way. The question is, if it cannot be impressed upon people to get at the man who is directly responsible for accident prevention. Probably the superintendent, the man to be held directly responsible, is the man directly interested. And possibly if the various companies were asked for the names of the various men interested in that work—I think every foreman will be more or less interested—I think possibly you will get at the right person to receive notices. And then ask him, or ask the company, to report back on the work he is doing.

Mr. Davies spoke about this physical examination of Dr. Mahaffy—I do not know how far he can be got in touch with in our National Electric. Personally I have been in close touch with this work, and there is a movement on hand to organize what is called "Safety First and Employees' Welfare." I think if the doctor's name was taken note of, that Dr. Mahaffy would be only too glad, only too pleased, as a matter of fact, to co-operate with us in this way.

E. L. Milliken, Sydney, N.S.: I have had the honour to be a member of this Committee; Mr. Maclachlan has never even met me until today. I have also had the misfortune not to be able to contribute very much toward the Report, which I presume he is entirely responsible for. Such things usually work around that way.

I rather take exception to why he had received no reply to suggestion sent out for co-operation. I did reply, but I am afraid that my position as a very negative member of the Committee was confused with my position as manager of the company.

About the only thing I had to suggest, aside from the work being done by the N. E. L. A., was this particular question of grounding transmission lines when work was being done. There occurred to me as I heard the Report read, however, a point which was not mentioned in the Report, and which I feel rather diffident about mentioning, not having told Mr. Maclachlan about it before, viz., that even in the turmoil of change over during construction or additions the utmost attention should be given to taking every precaution that you would take in ordinary normal operation.

Mr. Winters, Bell Telephone Company: I do not know whether the Bell Telephone Company is considered as a member company?

The President: Yes.

Mr. Winters: I just wish to remark that I do not remember ever having seen such a letter mentioned in this paper.

I think it well to have the matter on record that the low tension public utility companies should also be considered in the matter of any safeguards. We realize that they, perhaps, are not so important in the eyes of the electric power people as their own plant or their own interests; but still, they are there, and have to use the streets with the other electrical people, and therefore should have consideration. We have had a number of lamentable accidents unfortunately through circumstances, generally speaking, of a type of construction that was carried out to a large extent before there were any "safety first" schemes, when sufficient consideration was not given to the protection of other companies' plant and employees.

What I wish to place on record is that the Bell Telephone Company will co-operate in every way to reduce the possibility of accidents. We feel that the electrical companies must live, but they should consider the Bell Telephone Company should live also. I think that many of the gentlemen here will agree that we have always been agreeable to do anything that was possible to reduce the possibilities of accidents. And so far as the Bell Telephone Company are concerned, they wish to be in on any accident prevention schemes that are worked out, and I expect you will find that they will do their share and co-operate with any general scheme that is put in hand by the Association.

The President: Any further discussion?

Mr. Doddridge, Quebec: I was just going to suggest about the rubber glove business and covers.

Mr. Davies: If I might add to my remarks, I would like to ask

a question as to whether the Ontario companies are glad that they have been forced into protecting their men or not? (Laughter).

The President: What do you mean by "protecting their men"?

Mr. Davies: Being forced into the question of Workmen's Compensation. Of course, this thing may spread, and we are glad to know, if it is going to spread, whether it is a good thing or whether it is a thing that has to be tagged along?

The President: Any further questions?

Mr. A. A. Dion: I should like to say a word about the matter of Resuscitation. Mr. Maclachlan has, I think, given the impression in his Report that the prone method of resuscitation is to be depended upon rather than the mechanical means. I think it is a serious question at the present time whether the mechanical means are of any real benefit, as pulmotor and lungmotor. Personally, from all the evidence I have been able to gather, I should like to depend on the prone method above any mechanical method. But there is one very serious consideration, regardless of the merits of the two methods, and that is, that you can apply the Schaefer Prone Pressure Method immediately, whereas mechanical means are not available as a rule for several minutes, perhaps fifteen or twenty minutes, when it is entirely too late. I believe that in most cases it is almost useless to attempt any resuscitation after ten minutes, and it is very questionable whether it is possible in most cases to bring mechanical apparatus to the scene of the accident within that time. So that we should bear in mind, regardless of the relative merits of the Prone Pressure Method or the mechanical methods, that the Prone Method can be applied instantly, and for that reason, no matter what mechanical means you may provide, you should not neglect to educate your men thoroughly in the use of the Prone Method, because it can be applied instantly and the weight of evidence is to the effect that the first few seconds are the most valuable.

The President: I will ask Mr. Maclachlan to close the discussion with replies to some of these questions that have been asked.

Mr. Maclachlan: If you will allow me I will leave the reply with regard to Resuscitation to the last.

And first I want to thank Mr. McDougall for what he has said about me. I feel I have done very little, and it is only through the co-operation of the men in the different companies we have been able to get anywhere.

In answer to Mr. Davies, with regard to covers for rubber gloves, we were investigating the question of rubber gloves as a rubber glove and not the practice. In the United States in general it is not the practice to use covers for rubber gloves, and I think that is one of the chief reasons why we are using as heavy a rubber glove as we are at the present time. I do not think it is necessary to use

such a heavy glove to carry out the work. The general test is 10,000 volts for three minutes and you can get that with far lighter gloves than we are using; the idea in the States being to use heavier gloves and to do away with covers, as they are using more rubber to take up any of the wear. I think we can carry that out in Canada in a better way. The latest practice is to wear three pairs of gloves in summer, a pair of light cotton gloves, then the rubber gloves and then the buckskin cover. You may think a man will feel he has a pair of boxing gloves on, but he can do better work. He can go up a pole and stay there for four hours if necessary, wearing those gloves, with comfort, and when they take off the rubber gloves they are not stuck solidly to his hands as they would be in the average condition.

I am very glad to hear of the medical inspection work being carried on in Montreal. I don't know of any other companies in Ontario that are carrying on medical inspection along that line, but I have no doubt about it but what it is coming. It is being carried on with great success with a number of companies in the United States, but more particularly in the manufacturing companies.

I want to tell Mr. Grier that certain points I put like the one in regard to foremen were put in simply and purely to start a discussion such as has been raised, because I think foremen ought to be held accountable at least for a number of the accidents. Investigating accidents, I find that in a number of cases the foreman or superintendent is not hauled up on the carpet as to the accident to find out why it has occurred. The accident report is made out, and that is usually the end of it.

In connection with the letters that we sent out, we used the list of the Association, and if some of the companies have been neglected in getting that letter in the right place I am extremely sorry. But we have been dealing with the company as a company and not going into the company's own private way of handling a letter. Possibly it would be better another time of sending a leading letter first, and then following it up with a more detailed letter.

In connection with the question of resuscitation, I did not want to, in a report that is going to be public, condemn the pulmotor and lungmotor any more severely than I have. But I want to speak personally, and not as representing any association. I have advised in all cases that the Schaefer Prone Pressure Method be carried out and that the lungmotor and pulmotor, if it is on the job, be left in the cupboard because I think you will have far better results from the Prone Pressure Method. I would just like to read something from the Toronto paper. It was about a Bell lineman being killed and it reports "he got a shock, and the foreman who was in charge of the party stated that when he saw Scott grasp the wire he shouted to him to keep cool. Just as he did so Scott fell back lifeless. Examination shows there was no visible injury discernible beyond

slight burn on the hand. A pulmotor was at once rushed to the scene." It looks very effective to see a pulmotor rushing down the street. "After working over the man for three hours all hope of resuscitation was abandoned. The body was then moved to the City Morgue." That is the average case that we find. The only way to pull a man around from an electric shock is to have well-trained employees that will jump right on top of him inside of three minutes and start resuscitation. Your chances are far less after three minutes. You may be able to resuscitate in exceptional conditions, but if you try stopping breathing for three minutes and just see what you feel like at the end, you will know there is a very small chance of pulling a man around. That is why we say men have to be trained in the Prone Pressure Method. We have got three cases in Ontario—60,000 to ground, 23,000 to ground and one 11,000 to ground, that have been pulled around. It does not do to just train a man now and leave it to him to keep it up. You have got to have regular practices at least every two weeks to keep your men in any kind of shape and carry it out. You have then men who can be depended on and some gangs—Mr. Dion's company for one—that will go at it and start resuscitation in from 20 to 30 seconds. A man will take an injured man down from a pole in a minute and a half, and all that has to be done by training and constant drill.

Mr. Grier: May I make one suggestion in reference to this matter? It may not come up now, but I want to speak of it in view of the expression of willingness, to co-operate heartily, on the part of the Telephone Company, that in the composition of the Accident Prevention Committee it might perhaps be well for the members to consider whether it would not be well to add someone representing telephone companies.

The President: Mr. Davies asked a leading question in regard to protection of workmen through the Compensation Act in Ontario. I think it would be well if Col. Street, our ex-president, would reply to that.

Col. Street: Mr. Chairman, you have asked me to reply to a rather leading question by Mr. Davies, as to whether the present Workmen's Compensation Act of Ontario and the Employers' Electrical Association were working out for the benefit of the electric light companies. To start out I might say that the electrical companies in Ontario were forced to operate under the Workmen's Compensation Act by the Provincial Government. Naturally, it was very uncertain at the start whether these enforced methods were for our benefit or not. However, we have since found that so far it has not worked out to our disadvantage. How long this condition of affairs will exist, we of course are unable to tell.

There was an endeavor on the part of the Workmen's Compensa-

tion Board at the start to keep the rate under 1 per cent., but this was found inadequate and it has been brought up to 2 per cent., which, I believe, will be all that will be asked for some years. Consequently, members of the C. E. A. in other provinces who are still carrying accident, public and employees' liability insurance, will appreciate that our present rate is not excessive, as I believe they are yet paying to insurance companies from 2½ to 3 per cent. The Electrical Employers' Association was formed under the Workmen's Compensation Act and has worked distinctly to the advantage of the companies, no doubt largely due to the inspections carried on. We were able to obtain the services of our present Inspector, Mr. Maclachlan, and the good work he has done speaks for itself. No doubt through his efforts, accidents have been kept down.

While I am on my feet, I feel it my duty to refer to Mr. Maclachlan's advice in his remarks this morning, as to the training of men in resuscitation methods, which I consider particularly necessary at the present time. The war in which we are all participating to a more or less extent, is undoubtedly the cause of our looking somewhat more lightly than heretofore upon the loss of life. In reading of actions at the front, the loss of 100 or 500 men is considered comparatively small. Our electrical confreres now fighting our battles at the front will come back to us imbued to a certain extent with the feeling that after all the loss of one life is not a very serious matter. However, the loss to a company of an expert in the business is a serious matter, more serious if we consider that such life might have been saved if those about him at the time of the accident had been familiar with resuscitation methods. Consequently, Mr. Maclachlan's advice in that particular should be followed out in a most earnest manner.

The President: I would like to add to Col. Street's remarks in regard to the benefits of the workmen's compensation, that it seems to be the opinion, in sections around Toronto anyway, that the Workmen's Compensation Board have imposed conditions and rules in regard to paternalism to our men which, while a benefit, are apt to lead to bad results in the end. In this way, the fund and the premium are designed to make each group self-supporting. The overhead expense is pro-rated, subject to a certain grant from the Ontario Government. Our rates are high compared with company liability insurance. The labor element, which is strong and influential in Ontario, is continually making demands on the Government for additional concessions in the way of compensation. As the Act is designed at present, the liabilities on the fund for accidents to married men are very exacting. And if the increase in expense and the additional demands of the unions of the labor men have the same

weight as they have in the past, or increasing weight, it will become essential for the companies to further develop the physical examination feature mentioned by Mr. Davies. It will, in the opinion of some employers—not altogether electrical employers, but other employers—it will become when labor is plentiful a question of selection of employees, as the result of a fatal accident to a married man with a lot of children makes a very heavy drain on the fund. It may even, in the realms of possibility, come down to selection of single men or men with few dependents. If the Act is extended in the line that the unions are making demands—additional compensation, hospital attendance, nurse, first aid, and all this sort of thing—it may be necessary to make a very careful selection of your employees or the result will be that the fund will increase (as it has in some of the States of the Union), to such a high rate that it will have to be considered as a very important feature of operating expense. The only methods of keeping these claims down are through this Accident Prevention and selective choice of employees.

I think that practically covers our view of the situation. Some of the other groups have had their premiums materially increased. Ours, fortunately, as I said before, due to results which we give Mr. Maclachlan considerable credit for, has not yet been increased. But in a fund of this kind, administered by Government commission, and the investments of our monies made under political control, and beyond the control of the people who contribute, and where criticism is generally resented, the position is a difficult one, and we can see a likelihood of friction. The other groups have experienced some trouble and friction with the Board. We have steered clear of that. The other groups for a time were merged under the Manufacturers' Association, and attempted to advise the Board in one or two respects, and, I am sorry to say, did not receive much encouragement. That, I think, embraces the answer to the question of Mr. Davies.

If there is no further report I will declare the discussion on the Accident Prevention Committee Report closed, and I will call on Mr. Hyde, as representative of the N. E. L. A. Lighting Sales Bureau, to read his Report.

Mr. Hyde: Mr. President and Gentlemen, I think I appear to you in rather a unique position, inasmuch as being connected with an industrial rather than with a Central Station I have had the honor of being selected by your Executive Committee to represent the Canadian Electrical Association in the Sales Lighting Bureau of the National Electric Light Association. I therefore had to find something that would be a connecting link between these two organizations, where the service would be warranted and where I could submit to you something that would be of value and bring to you some practical results.

The paper that has been printed as a report of the Committee's work is, in fact, a report which I myself submitted to the Secretary of this Association with the idea that I was presenting a resume of the activities of the Committee as I was observing them in their progress, and it is not a report which states the actual findings of the Committee, and therefore I much regret it does not contain the meat of the efforts which were put forth by the various sub-committees of the Lighting Sales Bureau.

Report of Canadian Electrical Association Representative on LightingSales Bureau of the N. E. L. A.

As a result of sub-divisions in the work of Commercial Section of the National Electric Light Association of the United States, members of the Committee chosen to continue the work of the Lighting Sales Bureau for 1916-1917 met at Nela Park, Cleveland, Ohio, September 1st, 1916.

Mr. Thos. F. Kelly, Chairman, presided, and there were also the following gentlemen in attendance:—

N. H. Boynton—Acting as Secretary of the Meeting—Cleveland, O.
S. B. Burrows—Public Service Corporation, Newark, N.J.
Ward Harrison—National Quality Lamp Division of G. E., Cleveland, Ohio.
Oliver R. Hogue—Commonwealth Edison Co., Chicago, Ill.
E. C. Kimball—Boston Edison Co., Boston, Mass.
W. R. Moulton—Consolidated Gas, Electric Light and Power Co., Baltimore, Md.
C. E. Stevens—Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
A. J. Marshall—Recording Secretary of the N. E. L. A., New York.

Mr. Boynton was elected permanent Secretary of the Bureau for the term, and Mr. A. J. Marshall, as an executive representative of the Commercial Section, brought the connection between the Bureau's workings and the Commercial Section, of which the Bureau was one part, into closer intimacy, as he could supplement the Bureau's efforts, act as recording secretary of the meeting, and counsel against measures which might conflict with other Divisions into which the Commercial Section has been separated.

Committees designated as sub-committees of the Lighting Sales Bureau were then decided upon, and a chairman for each chosen, the work being assigned as follows:—

Committee	Chairman
Residence Lighting	W. R. Moulton
Electrical Advertising	C. S. Buller
Store Lighting	S. B. Burrows
Public Building Lighting	E. C. Kimball
Industrial Lighting	O. R. Hogue
Outdoor Lighting	C. L. Law
Commercial Aspects of Street and Highway Lighting	A. W. Young

Besides the above it was thought that a committee, to be named "Commercial Aspects of Lamp Equipment," and another, "Employing and Compensating Salesmen's Committee," should be formed out of membership on the Lighting Sales Bureau to do special work as suggested by the names assigned, but in no way conflicting with the Lamp Committee of the National body.

The establishment of committees under the leadership of their respective leaders, as given above, formed the groundwork to be covered in the real work of the Bureau, and in the concrete aimed to secure constructive data available to members relating to the following phases of Central Station lighting activities:

Increase business in houses already wired by introducing outlets for irons, toasters, etc. (in themselves current consuming devices), and ornamental stand lamps.

To show methods by which greater sales of current can be affected by lighting of bulletin boards, wall signs, roof signs, strip and outline lighting, window and interior signs.

Store lighting permits of better shop windows, rug frames, special color matching booths (daylight lamps), and efforts to increase foot candle intensities.

Public buildings such as churches, theatres, armouries, school houses, hospitals, libraries, federal and municipal buildings, office buildings, railroad and steamship stations, halls of apartment houses, hotels, bulbs, all offer opportunities for better lighting with the consequent increase in current consumption.

The subject of street and highway lighting seems to embody problems which are neither technical nor of importance because of the current consumed. While, of course, current consumption is not overlooked as a means to an end, yet the aim seems more in the direction of securing commensurate prices for street lamps where now installed, the prices obtaining being in the aggregate far lower than they should be. Obstacles encountered by the adverse attitude taken by the public in general, fostered by local newspapers and frequently championed by political axe-grinders, such as aldermen, councilmen, and in some instances by mayors or county commissioners, have made the work of educating the fair-minded in many communities extremely difficult, and the efforts of the Street and Highway Committee to secure useful data that are convincing and yet fair, by which the returns on street lamps in dollars and cents per lamp year from each community, and with variation in the rates commensurate with the difference in local conditions, both as they relate to the geography of the lighted areas and production costs of the current to the central stations, deserve special support and encouragement not to say mention in this report of the Lighting Sales Bureau activities.

In the 1916 reports some data are given showing increase in production and decrease in spoilage of materials manufactured in industrial plants. These data are to be further increased with other concrete examples, besides which examples of the better facility with which the incoming raw materials and outgoing finished products, can be handled outside factories, in yards and railroad sidings, will be given in the Industrial Lighting Committee's report.

The Outdoor Lighting Committee will present unique data more in line with new applications than probably any of the other subcommittees. The advent of the gas-filled incandescent lamp and its exceptional value in connection with projectors or so-called floodlights, gives this committee a newer subject with which to deal, but the unlimited expense and the enthusiasm and care with which they have secured data and co-related them deserves special mention and commendation. The lighting of recreation grounds, pageants, monuments, carnivals, military camps, bathing beaches, areas being excavated, strippings and the like, will be given attention, and photographs secured, besides which the whole mass of details will be carefully edited and prepared for reference.

Since the Nela Park meeting two more have been held, one at New York City, on November 24th, 1916, and again at Pittsburgh, February 16th, this year. These meetings devoted the time to reports on progress made, and the interchange of suggestions to stimulate further investigation into subjects under consideration. Also at these meetings steps to avoid duplication of effort have been taken and motions adopted which had for their aim more complete cooperation with the parent organization in its programme for the year and the presentation of reports and findings at the May annual convention.

The Bureau has also followed precedent by suggesting to the executive council the names of successors of the present officers and sub-committee chairmen of the Lighting Sales Bureau, who can carry on the work throughout the fiscal year ending May or throughout 1918.

Respectfully submitted,

E. N. HYDE,

Canadian Representative Lighting Sales Bureau.

The President: I think it would be a good thing, with your permission, to postpone the discussion of the Lighting Sales Bureau Report, which has been very instructive, until this afternoon, when we hear from Mr. Ward Harrison, on general illumination subject, and take up the discussion of illumination both from Mr. Hyde's Report and Mr. Harrison's Report. Is that agreeable? (Carried).

In that case we will now adjourn until 2.30. I hope everybody

will be in this room promptly, as we have a very interesting afternoon's list of papers.

——Meeting adjourned at 1 o'clock.

——On resuming at 2,30.

The President: I will call the meeting to order and ask Mr. Howe to give us a talk on Electro Chemical Products.

Electro-Chemical Products

One need not apologize for introducing the subject of chemistry in any gathering these days, for we have come to understand its relation to all phases of everyday life.

To quote "Casson," the Editor of the Efficiency Magazine: Mr. Narrowhead says, "What does chemistry mean to me?" as he looked at the page printed with ink made by a chemical process on paper made by a chemical process. He pushed back his cuff, bleached by a chemical process, and laced his shoes made of leather tanned by a chemical process. He glanced through a pane of glass made by a chemical process and saw a baker's cart full of bread leavened by a chemical process, and a draper's wagon delivering a parcel of silk made by a chemical process. He pulled out his pencil, made by a chemical process, and wrote a reminder in his notebook bound by imitation Morocco made by a chemical process. Then he put on his hat, dyed by a chemical process, stepped out upon the pavement or asphalt compounded by a chemical process, bought a daily paper with a penny made of copper refined by a chemical process, and proceeded to his office where he dealt in a certain chemical compound called "coal." "No," he added, "of course not, chemistry has nothing to do with me."

Electricity and chemistry are mutually helpful and necessary. Chemistry is the science of doing things quickly in accordance with Nature's laws and by utilizing electricity, chemistry is able to do in a very short time those things which have been done by Nature during geological periods of time. Many chemical achievements would have been impossible without electricity, and electricity very largely depends upon chemistry for its own accomplishments. For example, pure metals, especially copper, must be had, and the chemist is needed in their production. The whole field of insulation has called upon the chemist. It is said that even the fashion to wear tight skirts a few years ago led to a difficult chemical problem. Because of this tight skirt it was decided to lower the street car steps. This led to a new type of street car which required a different placement of the motors, which required a new sort of insulation, which was the problem confronting the chemist. The evolution of the "Mazda" lamp is a story of what chemistry and physics has been able to do for and with electricity.

Electricity is of special use to chemistry, because it is a form

of energy which can be controlled, is reasonably constant and dependable, is concentrated and lacks many of the disadvantages possessed by other forms of energy such as the products of combustion. Its only disadvantage is its cost.

Electricity was first applied in electro chemistry for metal plating. This is done either for the purpose of decoration, preservation or deception. The object to be plated is suspended from a cathode in a chemically made bath of the metal to be deposited. This metal also composes the anode and the direct current passing causes the ions to take the desired direction and the metal plates out. The impoverished solution then dissolves more metal from the anode.

We next find metal refining, which is the natural growth of electro plating. Copper is of special interest to electricians, and but for electrolytic refining it is difficult to conceive of much progress in the electrical field, for in no other way have we discovered how to make sufficiently pure copper. Bessemerized matte may contain copper sulphide, copper oxide, gold, silver, platinum, iron, nickel, arsenic and its oxide, antimony and its oxide, bismuth and oxides, selenium and tellurium. This matte is partially refined in the furnace and the resulting metal cast into anodes. Some of the impurities are dissolved, others become insoluble salts, others precipitate to the bottom of the tank, still others are unchanged and none of them plate under the conditions existing in the bath. The result is a nearly chemical pure copper.

Twenty years ago our present electro chemical development began. Some of the processes are electrolytic, others are electrothermic, and still others are combinations of the two. Aluminum is made by adding Bauxite to a fused bath of aluminum-codium-calcium fluoride. About 25,000 kw.h. per ton is required. Abrasives came next, and artificial abrasives at present supply us with nearly 100 per cent. of our requirements. They are harder and more constant in quality than the natural abrasives.

A furnace in which abrasives were being made was accidently over heated and particles of graphite were found in the interior. This was the beginning of what has become an industry upon which electricity depends nearly as much as upon pure copper. Artificial graphite and carbon is very homogeneous and better suited for use in batteries and as electrodes than the natural product; from a production of 800,000 pounds in 1900, the output has reached 40,000,000 pounds in 1916. The industry is still advancing.

Phosphorus is now made directly from phosphate rock or from bones by fusing the material with carbon and silica in an electrically-heated furnace. The whole process is thereby greatly simplified and more satisfactory results obtained.

Calcium carbide need but be mentioned, for I am sure you are

all fully familiar with its considerable economic importance. Alkali and chlorine either from fused salt or electrolytic decomposition of brine has meant much. It has provided cheaply one of the essentials in chemical manufacturing processes, i.e., alkali, and has made possible a whole series of products starting with chlorine in the form of gas or liquid.

The ferro alloys are now largely made in electrolytic furnaces. In such furnaces a high grade of steel can be produced, thereby displacing much of the crucible steel, for which foreign clays are required in manufacturing the crucible. Starting with a pure electric furnace steel, such other elements as are required for hardening or imparting other properties, can be added quantitatively and the heat then controlled to give very uniform results.

Electricity is now entering into the production of organic compounds because its use permits oxidation and reduction reactions to go forward without the introduction of extraneous materials. Chloroform is made from sodium chloride and acetone; Iodoform from potassium iodide and acetone or alcohol, and certain dyes are also made with the aid of electric current.

More recent and of great importance are the processes for the fixation of atmospheric nitrogen. There is the process using the arc type where great electro magnets are used to cause the arc to be fan shaped. There are a number of furnace designs. There is the catalytic process where nitrogen and hydrogen are caused to combine, and the method whereby cyanamid is made from calcium carbide.

Realizing as you do what quantities of electric power can be made available in Canada, the question may arise why cannot all these things find their own in Canada? The question is largely one of economics. In some localities electricity can be generated by using steam at a lower price than it can be obtained from hydro power. Then again, the raw materials required for some of these industries are not found near water power, while, finally, Canada has not yet attained a population dense enough to afford a consuming market. Electro chemical processes require large quantities of cheap power, and this power must be reliable: There must be no peaks in the supply curve where electric furnaces are in operation. Some processes require low freight rates, both for the raw material and the finished product. Others must be near consumers, and for all, a plentiful supply of raw materials and good labor are necessary.

The President: We are much indebted to Mr. Howe for this admirable and very instructive paper. I am sure there are a good many of you who have questions to ask Mr. Howe. The paper is open for discussion.

Mr. Howe: Before you pass to the next paper and if there are no questions, I would like to call your attention to the Hydro-Electric

Exhibit which we have in our offices at 137 McGill Street. This exhibit would have been disbanded some time ago but for this meeting, and we hope that some of you gentlemen will find time to come down and examine it. If you have not spent much time on the question of the relation of electric products to industry, I am sure you will find it worth your while to pay us a visit. Our office hours, ordinarily, are from 9 to 5.30, but we shall be glad to have some one on hand in the evening if that suits the meeting better.

Mr. Randall: That Exhibit, which is down in the Shaughnessy Building, is well worth going to see if anybody is interested in electrical power, because it shows what will probably be the biggest use for it in the next ten years.

Mr. Davies: I would like to ask Mr. Howe in connection with plating, if he has any information upon the selective plating that I have heard talked of. I have heard that by using different rates of current it is possible to selectively plate out different metals out of a mixture of salts.

One other point I would like to ask Mr. Howe to describe, and that is, how Crisco is obtained. At Mr. Howe's exhibition he has one of his electric products—Crisco. I believe it is electrically obtained, and I think it is very interesting to know the process, if we are going to have to use electrically prepared food in the future.

Mr. Howe: Inasmuch as I have agreed to speak to the Weekly Electrical Luncheon on the relation of electro products to other industries, I must be careful not to give you too many details or I will have a difficult task later.

Concerning selective plating, I believe it has been shown that this can be accomplished to a certain degree with brass plating. Few metals are plated in combination, most of them being used alone in the plating bath. As you know, brass is composed of copper, lead and zinc, and selective plating can be obtained to some extent.

The reason "Crisco" is to be found in our Hydro-Electric Exhibit is because it shows the utilization of an electro product. In the exhibit we have tried to interest everyone in the importance of research in the utilization of natural resources—in this case, hydro-electric power. To do this, we have begun with power and come down to the order of things which the man on the street can understand. For example, if I show you a globe filled with chlorine gas you must, in a measure, take my word for it that the color noticed is due to chlorine. If I show you bleaching powder you again must take my word for it, and to many, the white powder means little in itself, but if connected to this are to be found bleached and unbleached cloth, this application of an electrolytic product forms a starting point from which we may trace backward the steps which have led to the product which is understood.

Now, "Crisco" is an hydrogenated oil and the hydrogen used in the process is generally obtained by the electrolytic dissociation of water. The chemical difference between fats of the cottonseed oil class and those of the lard class is practically a few molecules of hydrogen, and ways have been found of introducing this hydrogen into the molecules, thereby increasing the value of low grade oil and making them applicable in some cases as food stuffs and in others for industrial purposes.

While mentioning food stuffs, I do not want to miss an opportunity to say that in some respects Canada has been lagging behind on some phases of the food question. I presume that you know that Canada is the only civilized country where oleomargarine is prohibited. Such legislation, to my mind, prevents a large portion of the population securing the requisite amount of fats for body growth and maintenance, because they cannot afford the higher priced butter, the most pronounced characteristic of which, as compared with oleomargarine, is the taste, to which we have become accustomed.

Mr. Foulds: I would like to ask Mr. Howe if the Cottrell Precipitator will ever have any market of any size for electric power?

Mr. Howe: With regard to power consumption by the Cottrell Precipitator, I cannot say from memory what it amounts to. I do know, however, that the number of installations is increasing and that a precipitator has very many applications. At the second National Exposition of Chemical Industries in New York last September there were fifty or sixty different products in the preparation of which the Cottrell Precipitator had been used. The precipitator has found its greatest field of usefulness in the recovery of dust from smelters and cement mills. As the population increases in the vicinity of such industries it will become obligatory for these industries to keep such dusts from the air. In many instances this has been done with monetary profit, in addition to the advantage of removing an admitted nuisance. The Research Corporation, to which Dr. Cottrell assigned his patents for the benefit of the people, have been overwhelmed with work and are constantly installing precipitators.

The President: We are greatly indebted to Mr. Howe for his address, and I am sorry that there was not more discussion, because there is nothing of more interest to power men than this growing market for power in large quantities.

On your behalf I wish to thank Mr. Howe for his invitation and for his address, and hope that a large number, especially the power men, will take advantage of his kind invitation to see this very interesting Exhibition. I would say that tomorrow afternoon we have a very short meeting, and probably around 4 o'clock will be a good time to visit this exhibit.

We will now proceed with the next number of the programme, address by Mr. Ward Harrison, of the National Lamp Works, Cleveland, on "Illumination." I have much pleasure in calling on Mr. Harrison.

Effective Lighting of Factories as Judged by Daylight Standards

By Ward Harrison

The all-important achievement in the pioneer days of steam railroads was to secure a locomotive which would run dependably, which would draw a load and draw it with reasonable rapidity. Little attention, and properly so, was given to the comfort or even to the safety of the passengers, for progress is accomplished most rapidly when all of the effort is concentrated on securing a device which will perform its primary function before attention is turned to refinements. Artificial lighting is no exception; for many years the chief aim has been to obtain better and more efficient light sources. Today, the first goal: "To make a place as bright as day," is close to realization, if not already achieved. Just as in railroading, however, it is found that the first accomplishment still leaves much to be desired. Judged from the standpoint of satisfactory and comfortable vision, there are but few locations where artificial lighting, though abundantly supplied, can be compared favorably with daylight.

Good lighting involves something more than mere intensity, and, as experience with "daylight" lamps has shown, something even more than simply proper intensity and color. The truth of the matter is that, disregarding efficiency, daylight intensities produced with the illuminants available 50 years ago, would often have more nearly fulfilled the requirements of good lighting than is done today. The light sources of that time were for the most part of such moderate intensity and brilliancy as to render unnecessary any special precautions in their use. Similarly, when railway trains ran 15 miles an hour, block signals were unknown and there was little need for a rock-ballasted roadbed. Unfortunately, in this era of high speed trains, high powered automobiles and high intensity lamps, too many of us are prone to believe that precaution is necessary with the first-named only.

It is true that as the intensity and intrinsic brilliancy of our light sources have increased, reflectors of better design have also become available which have shielded the eye to some extent, but applied to the general illumination of factory areas, the fundamental purpose of such reflectors has been merely that of increasing the percentage of useful light; increasing the comfort of the user has

been a secondary consideration. It is only with the latest improvements in incandescent lamps that there has come the realization that if we are to attain a daylight standard in the artificial illumination of factories, we must approach daylight diffusion or "softness" of light. Glare, specular reflection and quality of shadow, are receiving increasing attention. All are dependent, primarily, upon the area of the source of light.

Glare, as applied to light source, is a term which has not as yet been defined with entire satisfaction. In common usage any light source which is uncomfortably bright is termed glaring, but whether or not a source does produce discomfort is dependent in large measure upon the brightness of its surroundings and the length of time during which the eye is exposed to its rays. For example, out of doors in daylight, one will scarcely notice whether or not a bare tungsten-filament lamp is lighted, whereas at night the same source would be decidedly uncomfortable if close within the field of vision. Again, one may casually look out of an office window during the day and unless the landscape is unusually bright he will experience no sensation of discomfort; although to sit all day at a desk facing this window would, no doubt, cause most pronounced fatigue.

From the standpoint of glare, therefore, the light sources may be divided into three classes: those, such as an arc or bare lamp filament, which cause discomfort at once; those like the window, which after a time give rise to fatigue; and lastly, those which may remain in the field of view indefinitely without producing any sensation of

Table I.—Brightness of Artificial Light Sources.*

Crater of carbon arc	40,800,000
Flaming arc clear globe	2,435,000
Magnetite arc	1,945,000
Filament of gas-filled tungsten lamp	1,400,000
Filament of vacuum tungsten lamp (1.25 W.P.C.)	516,000
Quartz tube-mercury vapor arc	486,700
Filament of carbon lamp (3.1 W.P.C.)	236,000
Welsbach mantle	15,080
Cooper-Hewitt glass tube mercury vapor lamp	6,800
Candle flame	1,460
Sky, average brightness	2,000 - 1,000
Side of 25-watt frosted lamp	2,920
Bowl frosted 100-watt gas filled lamp (max.)	25,000
Ten-inch opal ball enclosing 100-watt tungsten lamp	306
Twenty-inch dome with concealed source, 200-watt lamp	930

*Derived from Cravath, Harrison, Pierce; Illuminating Engineering Practice, page 47.

glare. It is the growing conviction that under no circumstances should sources of the first class be tolerated within the field of vision. Those of the second class are usually satisfactory for all lighting installations where the light source need not be within the range of vision for long periods, or, at worst, not focused continually on the same portion of the retina. These include all passageways, store rooms, and other locations where workmen are not employed continually; also a great many factory workrooms where the closest vision is not required and the operators move about so that the

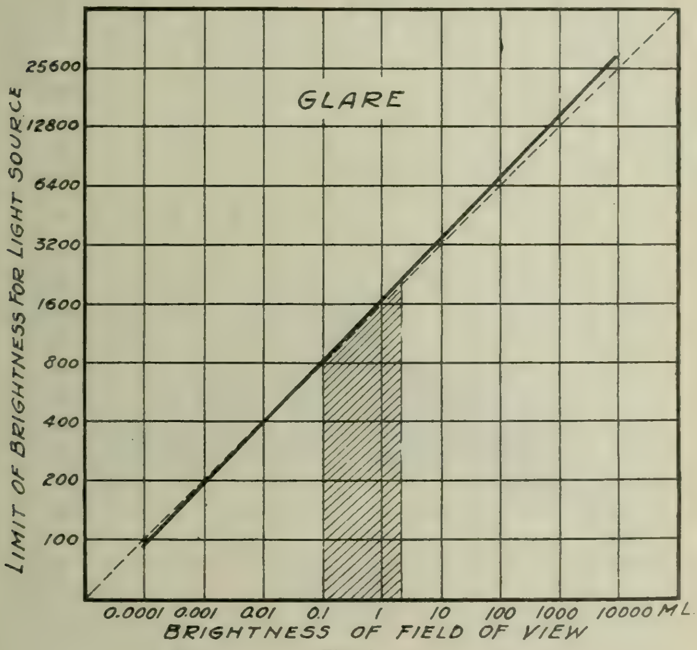


Fig. 1

light sources need not be continuously within their field of vision. In the third class, must be included offices, draughting rooms, auditoriums and other locations where the field of view remains fixed over a considerable period of time.

Unfortunately, the limits of brightness or contrast for these divisions have not as yet been definitely established. For the best diffused lighting required in offices and the like, it has been stated that the ratio of contrasts between the brightest and darkest objects within the field of view should preferably not exceed 100 to 1, which would mean that under ordinary conditions of artificial lighting the brightness of the source should be not more than 250ml., or

½ c.p. per square inch. The second class of light source properly includes those having a greater brilliancy than the limits given above and yet not bright enough in contrast with their surroundings to cause an immediate sensation of glare. Dr. Nutting has conducted an investigation with a view of determining the limits of brightness for this middle class. His data are represented by the solid line in Fig. 1. The cross-hatched section of the chart represents the limits of field brightness with which we ordinarily deal in the artificial

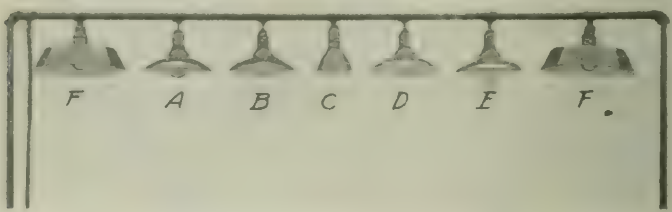


Fig. 2—Rack with Industrial Lighting Units

Fig. 3—Reflecto-Cap Unit

lighting of interiors. It will be seen that under a given set of conditions and an average brightness of the field of view of 1/10 ml., Dr. Nutting's data would indicate that a source of 800 ml. (approximately 1.6 apparent candle power per square inch) would just be recognized as glaring and that if the field brightness were increased ten times to 1 ml. the glare limit would be raised to 1600 ml.

It is interesting to note from Table 1, which gives the brightness

values for various light sources, that the candle flame is the only unmodified light source discussed which would not be classed as immediately glaring when measured by this criterion. The brightness of the candle flame is not far different from that of the sky, to which, of course, the eye has long been adapted. Again, it will be seen from the chart that increasing the average brightness level of the surroundings ten times permits of doubling the brightness of the light source without causing any increased sensation of glare. How closely the data adhere to this exponent throughout the entire range of observations may be seen by comparing the full line with the dotted curve.

In addition to direct glare from light sources, the element of reflected glare or specular reflection, is in some locations of equal or even greater consequence. The eyes may be shielded from the direct rays of a lamp, yet the image of this light source, reflected from the polished metal parts of a machine on which one is working, may be the source of most serious discomfort. It is obvious that the lower the brightness of the source the lower the brilliancy, and the less discomfort from the reflected image. If a light source is satisfactory as to glare when one looks directly into it, in most cases it can be safely assumed that its image will not be disturbing.

A third quality factor which must be considered in industrial illumination is that of vertical illumination or, rather, illumination of vertical surfaces. In an office one is concerned principally with books, papers, and photographs disposed in a horizontal or slightly oblique plane, and it is the lighting of this plane which is of importance. In the factory, on the other hand, objects of three dimensions are the rule, and illumination of their vertical surfaces is of nearly as much concern as that of the horizontal. A good intensity of light on the vertical wall surfaces is also conducive of an impression of brightness and cheer throughout a room. To provide good vertical illumination, a light source must have fairly wide distribution of lights, that is, give satisfactory intensity at angles as high as from 65 to 75 degrees from the nadir.

Finally, the question of shadows must be considered. For satisfactory general lighting there must be no shadows so dense as to make vision difficult where the direct light from one or two sources is cut off, nor so sharply defined as to confuse the worker; in other words, shadows should be soft and luminous. In this connection it must be remembered that the entire elimination of shadows is not an end to be desired in industrial illumination. From successful trials of indirect lighting in offices, some factory managers have drawn the conclusion that the indirect system is ideal for all locations, and that it is simply the question of operating cost and maintenance which has prevented the universal application of this sys-

tem. However, the distinction must be recognized that in offices close scrutiny is limited to plane surfaces and that printed words and figures are rendered legible by differences in color and contrasts in brightness with the background. Specular reflection and shadows are of no aid and they usually do harm. On the other hand, it is universally recognized that evenly diffused light makes sculpture appear flat and uninteresting; the eye cannot readily grasp the form of the objects viewed. For the same reason that we prefer directed light for works of art, we need it for the easy vision of objects of three dimensions in the factory. Here, as in sculpture, differences in color and in brightness are usually too minute to be depended upon for quick and accurate vision; in fact, a slight specular reflection is often of great assistance, especially in inspection work.

To sum up, then, the ideal source for factory use must be low in brilliancy to minimize glare and specular reflection, sufficiently

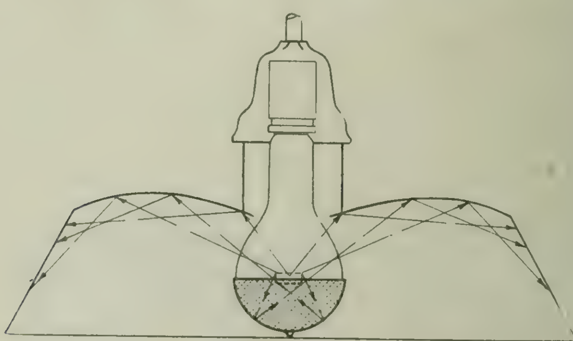


Fig. 4—Cross-section of Reflecto-Cap Unit

large in area to give soft shadows, small enough to insure a directed light, and must show reasonably good candle-power values at angles 65 to 75 degrees to supply satisfactory vertical illumination.

The foregoing discussion may perhaps be made more clear by a comparison of some concrete examples. One of the most popular units developed for general factory lighting was the dome shaped steel reflector and vacuum incandescent lamp of from 100 to 250 watts, Fig. 2-A. Although the intrinsic brilliancy of the lamp filament was high the reflector shielded the eye to some extent and hundreds of thousands of such units were used with satisfaction, especially where the mounting height was more than 10 feet above the floor. On the other hand, when a gas-filled lamp of corresponding wattage was substituted in the same reflector, Fig. 2-B, the discomfort was greatly increased, due both to the higher intrinsic brilliancy and greater concentration of the filament. The obvious remedy was to use a reflector which protected the eye to a greater degree,

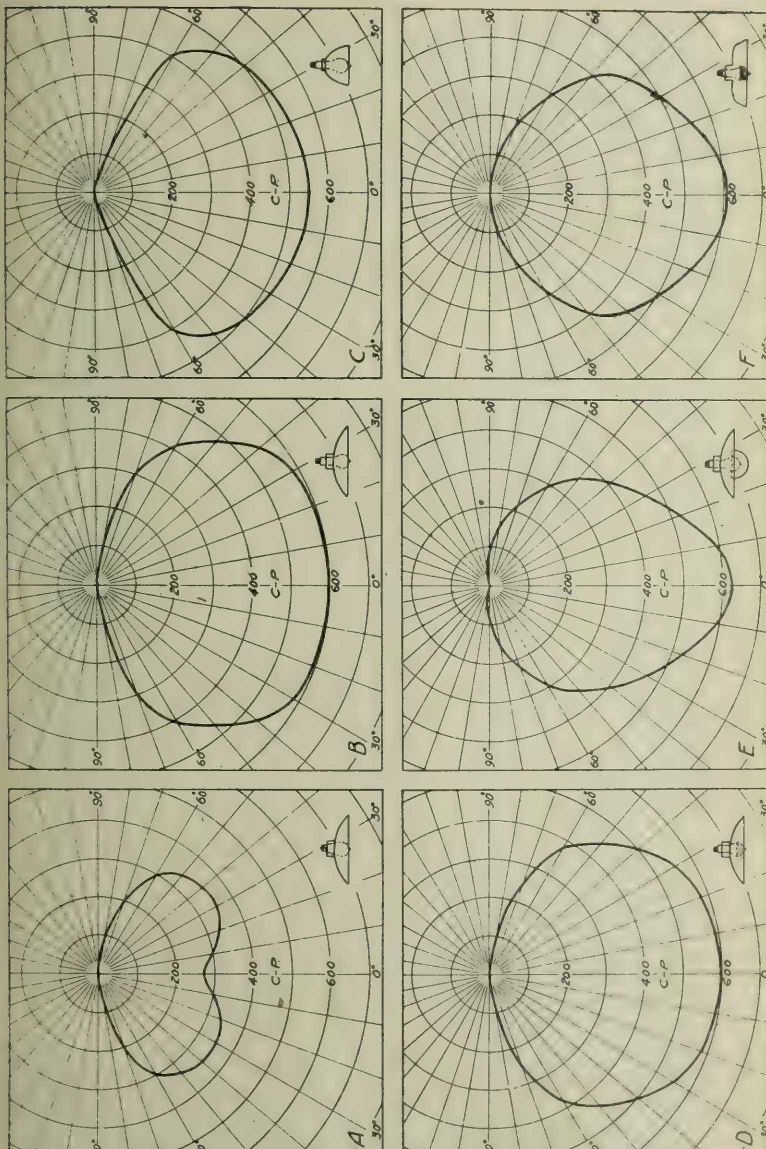


Fig. 5—Distribution Curves for Industrial Lighting Units

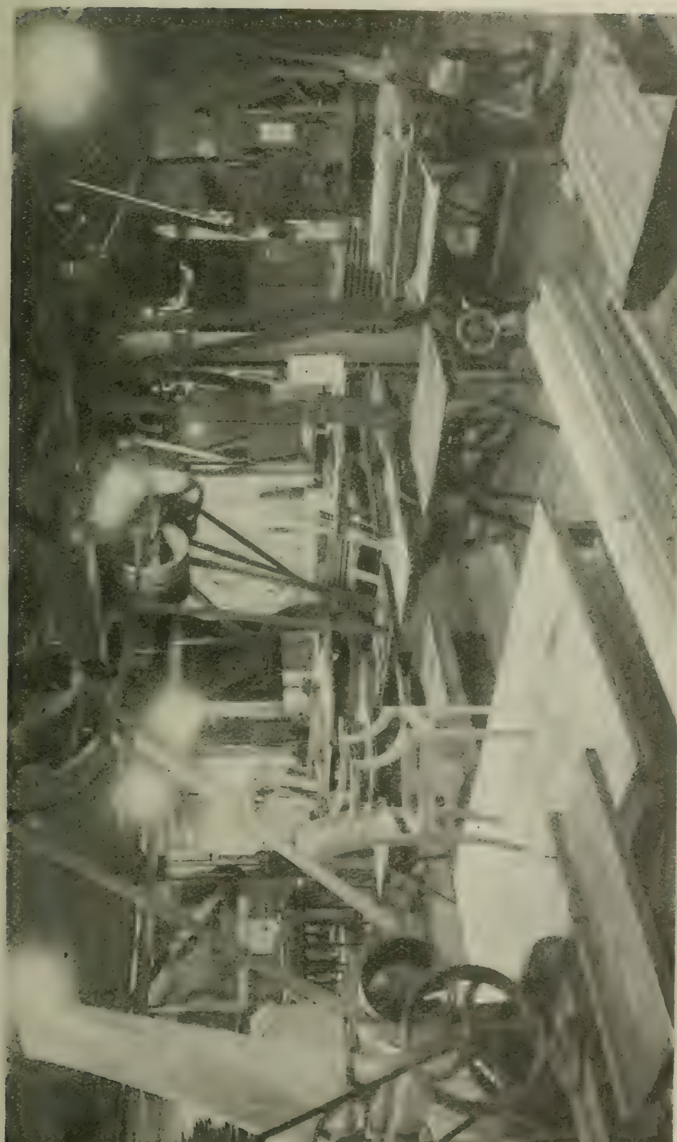
and, consequently, those of the bowl type, Fig. 2-C, were specified in great numbers. This unit shields the eye somewhat from the direct glare, but from the standpoint of specular reflection is, of course, in no way superior to the dome, and is markedly inferior to it in efficiency. From the illumination standpoint the use of a bowl-frosted lamp in a dome reflector, Fig. 2-D, is superior to the bowl in almost every respect.

Further efforts to diffuse the light have developed a variety of so-called semi-direct units, in which an opal bowl or cup was placed beneath the lamp to diffuse the light and redirect a portion of it against the larger area of the reflector above. Figs. 3 and 4 illustrate a unit of this general type designed by the writer, in which a silver cap is used instead of an opal cup. In this case no direct rays from the lamp filament reach the eye. It has an advantage over the opal cup or bowl for factory use in that the polished metal surface permits of a better control of the reflected light, and hence, a more even distribution of brightness over the upper reflector. Another advantage is that the cap fits closely to the bulb, precluding the collection of dust on both the lamp bulb and the reflecting surface. The contour of the porcelain reflector, as shown in Fig. 4, is such as to minimize glare due to specular reflection from its surface. Fig. 5 gives the distribution for each reflector equipped with a 200 watt lamp.

Table 2 has been prepared in an endeavor to show at a glance the relative merits of the different types of units discussed. Line No. 1 shows the percentage of clear lamp lumens. In line No. 2 is shown the relative horizontal illumination under usual conditions. These figures are not in all cases proportional to those on the line above because of the relatively more favorable distribution of some units so far as downward light is concerned. On the third line, rating

Table II.—Comparative Value of Industrial Units

	Dome Clear Reflector Lamp	Bowl Clear Reflector Lamp	Dome Frosted Reflector Lamp	Dome Opal Reflector Cup	Dome Mirror Reflector Cap	Opal with Globe Reflector
Clear lamp lumens—total	..	..	..	68	..	70
Lower Hemisphere ...	77	66	72	66	58	57
Relative horizontal illumination	100	91	95	85	84	71
Relative vertical illumination	A	C	A	A	B	A
Direct glare	D	D	C†	B	A	B†
Reflected glare	D	D	C†	B	A	B†
Shadows	C	D	B	B†	A	B
Maintenance	A	A	B	D	C	C



Seventy-five watt bowl frosted high efficiency tungsten lamps in dome reflectors provide the illumination for this cabinet-making shop.

has been rather arbitrarily assigned to the various units with respect to illumination of vertical surfaces for a given intensity of horizontal illumination. In the last line the relative values are assigned to the units as regards the cleaning and attention required to keep each type in good operating condition.

An entirely different aspect of good factory lighting which is worthy of serious attention is one of economics. Many engineers are already familiar with data which show how insignificant is the cost of good illumination in comparison with the value of a workman's time. In fact, one need frequently save only 30 or 40 seconds in an hour to entirely offset the cost of lighting. There is also another consideration, namely, the saving in overhead expense, which may be effected by using a factory building and its equipment for a greater number of hours per day, made possible by adequate provision for the artificial lighting.

As an illustration, let us take the case of a manufacturing concern operating to full capacity on a day shift only. To increase the

Table III.

WORKING INTENSITIES OF DAYLIGHT ILLUMINATION IN FOOT CANDLES

Factory Products	Grade of Work		
	A	B	C
Engine lathes — Horizontal Vertical, Min-Max	10 6 – 15	7 2 – 15	.3 .05 – 9
Automatic engine lathes	14 2 – 30	12 2 – 30	10 1 – 15
Machined forgings		6 2 – 15	5 1 – 10
Special machinery	10 4 – 20	7 .3 – 15	
Lamps	10 5 – 16	9 11 – 15	
Vacuum cleaners	17 7 – 25	11 3 – 20	
Automobiles	5 2 – 11	5 2 – 8	5 3 – 11
Automobiles *	10 6 – 12	3 1 – 3	5 4 – 5
Storage batteries		5 1 – 6	3 05 – 5
Machine tools and patterns	6 2 – 16	9 3 – 35	
Sheet iron equipment	10 1 – 20	5 1 – 12	8 2 – 15
Machine gears	7 3 – 16	8 5 – 18	5 1 – 15
Hardware	10 1 – 20	10 1 – 20	4 05 – 12
Printing machinery		5 1 – 15	3 05 – 5
Sewing machines		4 1 – 8	2 2 – 5
Cloth bags		5 3 – 10	7 3 – 10
Clothing	10 10 – 20	4 7 – 15	
Furniture	5 3 – 20	5 0.5 – 12	
Average	10 4 – 18	7 3 – 15	5 1.5 – 10

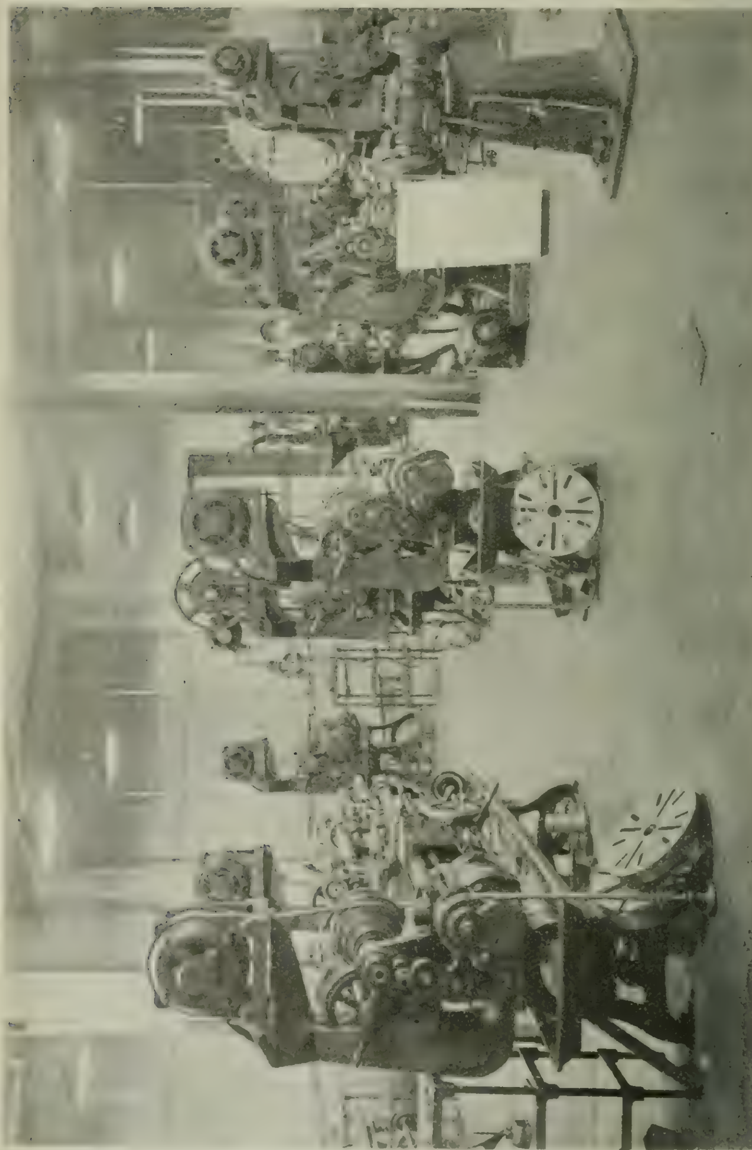
* Saw tooth roof

output of the plant to meet any further demand it becomes necessary either to provide additional machinery and working space or to operate the plant at night. Except for those industries which by nature require continuous operation, night work in the past has always been looked upon with disfavor; simply dismissed from consideration with the statement that men cannot work efficiently under artificial light. In general this has been true, but would it not be worth while to determine how much the cost would be to illuminate a plant at night in a manner to compare favorably with daylight in every respect, in intensity, softness, diffusion, and, if necessary, even in color.

To do this for any given factory it is first necessary to know how much light is obtained during the day. Table 3 gives a summary of several hundred readings recently made to determine the intensity of daylight illumination in representative manufacturing plants. Each figure given is the mean of a number of observations and the measurements extended over both clear and cloudy days. The aim was to secure data which represented good average working conditions. The test plate of the photometer was placed as close as possible to those parts of the machine at which the operators' attention was ordinarily concentrated. Factory processes were divided roughly into three groups in accordance with the relative necessity for accurate vision; it will be noted that in general the operations requiring closest attention (Grade A) were ordinarily best lighted, for wherever possible such machines are located near to the windows. Just below the data on horizontal illumination there is given in each case the results of readings taken in two vertical planes, toward and away from the windows. It is interesting to note that the horizontal intensity roughly approximates a geometric mean between these values; the effect of the saw-tooth roof construction in equalizing the illumination in all planes is also evident.

To produce an illumination varying from 5 to 10 foot-candles in the different departments of a factory would under present conditions require an expenditure of a little more than one watt per square foot of floor space, assuming that well-diffused lighting units were to be employed. With current at 2c per kw.hr. the total cost of lighting should not exceed .003c per square foot per year for a night shift of 2,500 hours.

If, on the other hand, doubling the size of the factory and operating on a day shift only were to be decided upon we would have to compare with the 7.5c per square foot annual cost of lighting the annual rental value of the addition to the plant fully equipped with machinery and ready to operate. Typical data on this point



Special 20 in. dome reflectors with silver capped 200 watt high efficiency gas-filled lamps in a machine shop.

are given in Fig. 6, which shows a range of various plants of 30 to 75 cents per square foot per year, annual charge to cover interest, depreciation, and taxes on the plant and its equipment. The rental value depends somewhat on the location and type of construction but largely upon amount of machinery required. Thus the charge for a plant of 100,000 square feet area would fall between $35,000 and $75,000, depending upon the industry. The cost of lighting this plant for night shift operation would not exceed $7,500. This saving, $20,000 - $70,000, represents the difference between success and failure for many companies. To look at it from another viewpoint, the consumer's viewpoint, rent now comprises from 15 to 30 per cent. of the increase which accrues to raw material in passing through a manufacturing establishment. Night operation should effect a substantiol reduction in the cost of manufactured articles.

But granting these facts, there remain the objections often raised that men do not like to work at night, that good men do not have to work at night, that it is impossible to change the established mode of life, and that really restful sleep cannot be secured during the day. Of the four, this last objection is a valid one; in fact, it is an open question whether satisfactory service can ever be obtained from a shift which begins work at midnight. On the other hand, man's preference for working during daylight is in many cases nothing more than an outgrowth of the fact that until recently effective

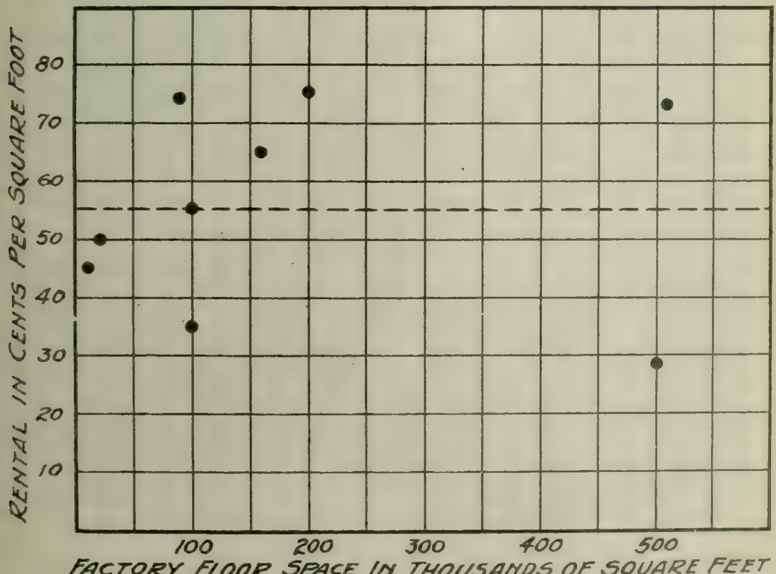
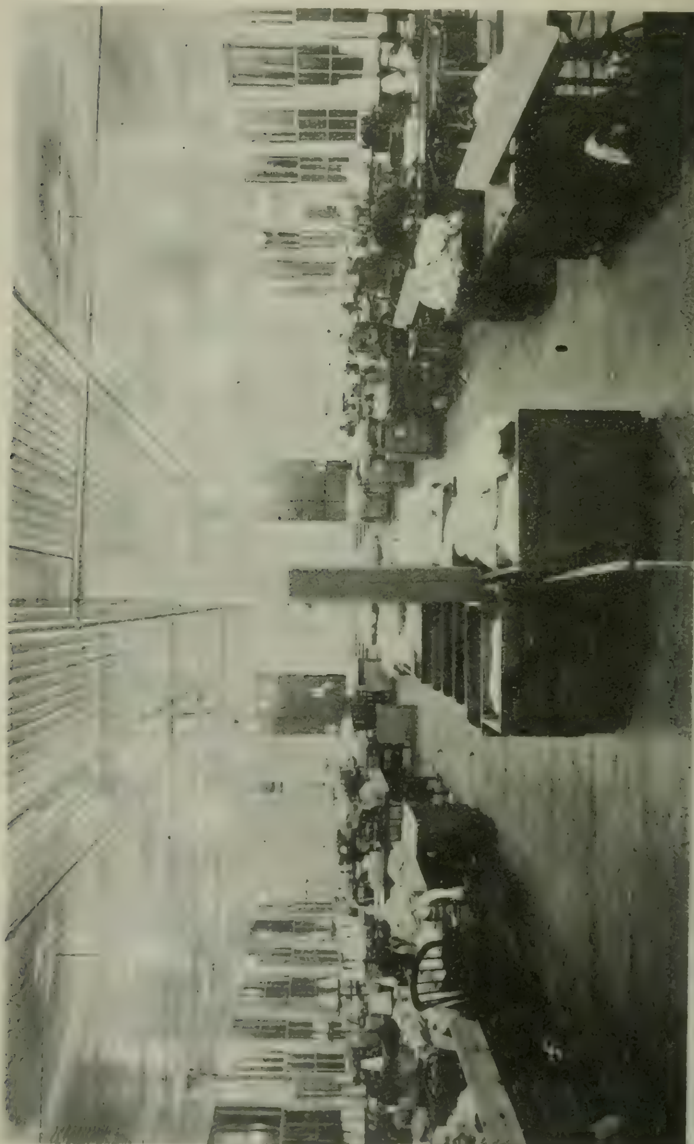


Fig. 6



A knitting mill illuminated with semi-enclosing units—.75 watts per square foot.

work could not be done under artificial lighting, and that amusements have gradually come to appropriate that part of the day which was otherwise unoccupied. If factories were operated on a morning and evening shift, the latter ending by midnight, the ordinary hours of the rest would be but slightly disturbed, and amusements which are dependent for their success upon a man's leisure time and his money would soon adapt themselves to the change. Under these conditions one would anticipate much less objection to night employment.

[Owing to the fact that it was understood that a copy of Mr. Harrison's remarks would be available for the printer, no verbatim stenographic report was taken down. It appears, however, that this understanding was incorrect, and we have, therefore, printed above a very similar talk given by Mr. Harrison before the Illuminating Engineering Society of New York. This covers practically the same ground and the discussion that followed is, for all purposes, applicable].

The President: Now, there is no subject that should be of more interest to Central Station men than the question of illumination. It is a subject that has been neglected too long. And if we have the interests of our customers at heart we should be able to advise them on the best methods that the development of the science has produced.

I understand that in Chicago, while the connected load in lighting is about 20 per cent. of the total, yet the revenue represents nearly 50 per cent. of the total revenue. That probably is more or less true of a good many of our properties. Surely sources of income representing 50 per cent. of the revenue of the company are worth developing and giving more attention to than we have in the past. This question of illumination, together with Mr. Hyde's remarks this morning, are somewhat synchronous, and we have here next on order Commercial Light and Power Committee Report, somewhat along the same line, together with power uses, etc. I think we will postpone discussion on the whole subject of illumination until we hear this next report. Unless there is some question that some member would like to ask Mr. Harrison I will take it as your pleasure that we proceed with the Commercial Light and Power Committee Report, which I will ask Mr. Gilman, the Chairman of the Committee, to read.

Commercial Light and Power Report

Mr. Gilman:

To the President and Members of the Canadian Electrical Association:

Gentlemen: In presenting our report herewith your Committee has endeavored to mention briefly a few only of the more important

subjects of present-day interest to our commercial members. In order to cover the field as thoroughly as is practicable in so limited a paper, we have confined our scope to the four following subdivisions:—

Lighting and Motor Power Sales,
Electric Ranges,
Electric Vehicles,
Other Uses of Electricity.

Lighting and Motor Power Sales

Residence and Store Lighting:

By far the great majority of our Member Companies primarily were distriubtors of lighting service only—many in fact did not operate their stations during day-light hours. The coming of the alternating current motor, with the consequent rapid increase of motor power sales, has changed all this.

Today, with nearly all of us, the ratio of the lighting output to the total kilowatt-hour sales, is steadily decreasing. Fortunately, however, due to the lighting rates being higher than the power rates, the decrease in the ratio of lighting income to total revenue is not so rapid. Our lighting customers show a steady natural growth in number. The income from these customers, due, first to rate reductions (possibly ill-advised in many cases, when viewed in the light of today's operating expenses), and second, to the marked increase in lamp efficiencies, does not show a proportionate growth.

The advent of the half-watt lamp now coming quite generally into use, in sizes as low as 60 watts, is in itself serious, and must lead us to expect considerable further improvement with a cumulative effect of lowered lighting income.

In the past we have seen that it has paid well to employ competent power engineers to assist our motor customers in receiving the service we have been prepared to render. Aggressive policies toward obtaining all available power business have so increased the power output that with most of us it now forms by far the greater percentage of the total output, and a constantly increasing proportion of the total revenue.

Rather than to tamely watch our lighting business take a back seat, we should pattern after our power experience, and apply correspondingly aggressive tactics. We need competent salesmen to handle our lighting problems precisely the same as power engineers are required to solve power problems.

At a time when all service and line materials are daily soaring to new heights, we should practice intensive rather than extensive methods of income increase. Lighting service is not expensive. To

the average consumer, either residence or commercial, the cost of his lighting is hardly noticed when considered with the other operating expenses. As an offset to the increasing lamp efficiencies, let us secure even larger increases in our existing customers' lighting consumption. This may be done by means of systematic effort on the part of our experts on illumination to encourage:

(1) The use of higher intensities of light;

(2) The adoption of indirect and semi-indirect system of illumination.

(3) The use of light of controlled color.

It is generally known that even the brightest interior by artificial light employs only from one-tenth to one-fifth the intensity of daylight. Let us make more general use of the gas-filled lamp, but in doing so properly conceal the source of the light, so as to avoid all glare. By so doing, an intensity of double that of the average present artificial light can be attained, with better economic results both to our customer and to ourselves.

We should co-operate with our glassware manufacturers to see that our semi-indirect units are constructed of sufficiently dense material to effectually do away with all glare. Some of the glassware now in use is almost as bad as the bare lamp. Possibly our occulists will notice a decrease in the number of their patients suffering from eye strain, and certainly our lighting incomes will increase.

The blue glass "day-light" lamp is coming into favor rapidly with department stores, for purposes of color matching, etc. It is very doubtful if the store managers feel that the increased consumption of electricity required to give even a moderate light intensity is not worth while. The proper color at the light source—for instance, the use of amber bulbs with dense semi-indirect glassware—will require considerably more current and the bills will be higher, but the results to the customer will be such as to more than warrant his increased expenditure.

Industrial and Flood Lighting:

It is felt that now is an opportune time to devote more of our energy to the bettering of the lighting in our factories. War orders are causing a large number of these factories to operate throughout the 24 hours, and ample lighting is not only desirable, but absolutely essential if spoilage is to be reduced and accidents avoided.

Brilliancy should not be mistaken for illumination. It is practically necessary always to combine proper general illumination by means of large units correctly spaced, with localized lighting over equipment requiring a higher intensity of light.

Protective lighting for industrial plants and other places of

strategic importance, is receiving considerable attention and should be encouraged, if for no other reason than because the proper use of artificial light during times of war will release large numbers of guards for more effective use in other fields. Gas-filled lamps of 400 or 500 watts with suitable reflector equipment are generally employed for this work.

A very interesting example of the value of flood lighting is afforded in the asbestos mines at Thetford, Quebec. By installing flood lighting for their pits and thus operating 24 hours daily, the management have been able to largely increase their output without increase in equipment, and incidentally, the central station supplying the electrical energy has been able to supply about half again as much energy to the motor equipment of the mines, due to an increase in load factor from 45 per cent. to 65 per cent.

Motor Power Sales:

Perhaps never in the history of the world has the central station proved itself of such immense value as since the outbreak of the war. Nearly all of our munition output is dependent upon central station energy. Manufacturers have been enabled to speedily double and triple their plants, and have always found a reliable and adequate power supply at their door.

On account of such general increases in the demand for power, a number of our member companies are now finding it extremely difficult to continue to take on power business. We urge that special consideration be given to the important matter of adequate protection against low power factor operation on the part of customers. Suitable clauses in power contracts should be inserted to enable the company to receive rightful compensation for existing low power factor. The enforcing of such clauses will be found of the greatest aid in influencing customers to alter existing methods to conditions more suitable to the power supply authorities. Certain water power plants are unable to take more water and have been forced to install added steam capacity. The difficulty in receiving the requisite coal for the steam operation renders the operating superintendent's position anything but pleasant.

Some of our companies are giving considerable attention to the sale of "interrupted power," and are making contracts whereby the purchased energy may be cut off during peak hours. The sale of this "off peak energy" has not been confined to users of large blocks of power, such as electric furnace plants, etc., but has been extended to include hotels, office buildings and factories where isolated plants are being operated during peak hours. By thus taking advantage of

local conditions the central station is enabled to continue to increase its power revenue, without adding to its peak load.

Electric Ranges

This subject naturally presents itself to your Committee from the viewpoint of the central station, and for the present, having regard to our purposes, the matter will be considered chiefly from that angle.

The demand made upon central stations in industrial centres in Canada to operate munition plants and allied industries, has, in many cases, called for their entire reserve capacities to meet the requirements, and in consequence the development of the range load has suffered. There is, however, a very general interest on the part of the public on the subject of electric cooking, and more particularly in the natural gas belt in Western Ontario, where the gas distributing companies have failed to properly take care of the business.

As to the future of the electric range business, the consensus of opinion among ceneral station men throughout Canada and the United States, is that it is now on a sound basis and that its adoption will be universal within a very few years. There is considerable diversity shown in reports as to the revenue which may be expected from this source, due to widely varying rates and forms of contract, but it may be stated without hesitation that the average revenue from range customers is approximately twice the lighting bill.

The character of the load is of vital importance to central stations. The range load will undoubtedly come on the daily peak of the average central station to a certain extent, but the development of ordinary lighting business will increase the peak in any event, without filling up the valleys in the way a range load does. Ranges utilize a considerable amount of energy between 11.30 a.m. and 1.00 p.m., at a time when power business makes its smallest demand during daylight hours. It has been stated when the electric range comes into general use among all classes of customers that the station peak will occur between these hours.

The maximum demand of the individual range averages about 50 per cent. of the connected load, while the maximum demand of a group of twenty ranges, or more, rarely exceeds 15 per cent. of the total capacity. It will be seen that while the maximum demand of an individual customer may seem high, and in consequence of this considerable additional investment may be necessary to take care of the isolated customer, that the business lends itself most acceptably to intensive cultivation. The result of this, in view of the very wide diversity consequent upon the fact that cooking conditions in no two homes are exactly alike, is a very low demand in proportion to the connected load. To put it briefly, the more ranges connected.

the lower the demand factor will be. To illustrate this point the maximum demand on

A single range is approximately 50 per cent. of the connected load.

On three ranges is approximately 33 per cent. of the connected load.

On twenty ranges is approximately 15 per cent. of the connected load.

A class of business very closely allied to electric cooking is that of water heating. One can scarcely be considered without the other, for very often the installation of an electric range means the removal of the old method of heating water for domestic purposes. While the load characteristics appear to oppose each other they have a complementary effect in balancing the load curve. The peak of hot water heating often comes on as late as 10.00 p.m., where heaters are used to a large extent for dish washing and bathing. The report of the Electric Range Committee for the 1916 Convention of the N. E. L. A. goes very exhaustively into this subject and consequently the present article will not deal with the matter in detail.

One of the principal member companies in Canada is engaged at the present time in working out a plan to sell, on a term basis, electric ranges connected up ready to operate. The same company has in effect a water heating proposition under which they furnish, install and connect water heaters for a definite sum. These heaters are arranged to be connected for 500 watts under a flat rate, and 2000 watts through the meter. Current for the high heat is sold at the residence rate—the heater consumption usually being billed entirely on the third step of the rate, which is low.

It is recommended that so far as possible, water heaters installed in connection with ranges be placed on a double-throw switch, so that the water heater is not in circuit while the range is in use.

Development of the Business

The following brief statements are the views of representative central station men in touch with the demands of the situation.

"Central stations must plan to take care of as much business as gas companies have in ranges."

"Efficient salesmen specializing in the business of ranges must be employed."

"Educate the customer in efficient operation."

"A national publicity campaign on the ease, safety, cheapness and other advantages which the electric range alone possesses."

"Central stations must sell Service rather than kilowatt-hours, and Cooking rather than Ranges."

"The fullest co-operation must obtain between the manufacturers, contractors and central stations."

It is clear that we must begin at once to take electric cooking and auxiliary heating seriously, and exercise the greatest care in its development, as this will result in very greatly increased output. Every commercial manager will have his own problems to work out. Some of the difficulties in the past have been:

(a) **Unfamiliarity on the part of the housewife with electric cooking.**—This has been dealt with in the foregoing statements.

(b) **The cost of energy to the consumer.**—No definite figures can be given as to the price per kilowatt-hour which should be charged for service. This will depend upon local conditions, the cost of supplying power, as well as the cost of competitive methods of cooking. It may, however, be stated that to fully develop the field will require a rate not in excess of 4 cents per kilowatt-hour.

(c) **Cost of Ranges and Range Connection.**—While industrial conditions as at present preclude any immediate reduction in the cost of ranges or connection, we may look for marked reductions in prices as time goes on.

The cost of connecting ranges at the present prices for labor and material is high, and a careful study should be made with a view to lowering this cost and at the same time keeping in mind the requirements of safety.

The high efficiency of the electric range and its manifest benefits, however, make it very attractive, even under present-day conditions.

(d) **The Cost of Distribution.**—Many companies are not prepared, so far as their circuits are concerned, to take on cooking load without some considerable additional expense. It has been established that the cost of individual service ranges from $75.00 to $100.00. As the business grows, however, the cost per customer will decrease considerably. In fact, three customers can be connected for twice the cost of one. When the revenue to be obtained from this expenditure is taken into account and the fact that the load has a power factor of 100 per cent., it will compare most favorably with power business.

Good regulation is very important in supplying a satisfactory range service. The question of keeping down the cost of distribution and at the same time providing satisfactory regulation, is a most important one, and one that your Committee recommends the Association to carefully investigate.

It seems best that stove services should be put in on the 3-wire, 110/220 volt system, and that ample transformer capacity be pro-

vided, either by banking existing transformers or the installation of larger units.

It should be noted, however, that in Canada the stove load overlaps the lighting peak for a short period only, and only in the cold winter months when the transformers can safely carry considerable overloads for the short period of overlap.

Construction of Ranges

The consumer is now no longer limited to a selection of two or three makes of range. There are a considerable number of manufacturers furnishing a satisfactory product, but it seems desirable, as yet, that ranges should be sold through the central station. The principal feature is necessarily the burner. The two standard types are the open coil burner, producing heat by radiation, and the closed coil burner, operating on the principle of conduction.

Manufacturers are guaranteeing a life of from 4500 to 5000 hours for their burners, and they can be readily renewed at a very reasonable cost.

The following features are now regarded as essential to a good range:

Some device to indicate whether the current is on or off.

Standard elements easily, quickly and cheaply replaceable and interchangeable as to size.

The construction of the oven and its burners should permit of the oven being thoroughly and easily cleaned. The lining should be so made that it is impossible for cooking vapors to get into the heat insulating materials.

A reliable thermometer.

Terminal contacts so placed as to give the minimum of trouble.

Separate fuses provided for the various burners.

Rigid construction of the stove frame.

Warming oven should fulfil its function.

The following are a few of the advantages to the consumer in the use of the electric range:

(1) Kitchen cleanliness—no soot, dirt or grease.

(2) Bright, clean and attractive appearance.

(3) Economy and Efficiency—no great loss in shrinkage of food.

(4) Safety—no flame or explosions.

(5) Personal comfort.

(6) Saving in space—of particular advantage in apartment houses.

(7) Sanitary—no poisonous gases, oven can be kept thoroughly clean.

(8) Regulation, perfect control.

(9) Even temperature.

(10) Coolness, no waste of heat.

(11) Certainty in results.

(12) Perfection in baking or broiling.

(13) Appetizing food, digestible and nutritious.

(14) Progressive—last word in development of household cooking.

Attention is directed to the following publications on this subject:

The Report of the Electric Range Committee. Presented at the 8th Annual Convention of the Northwest Electric Light and Power Association, Portland, Oregon, September, 1915.

The Report of the Electric Range Committee, 39th Annual Convention of the N. E. L. A., Chicago, Ill., May 22nd, 1916.

Brighter and Happier Hours in Your Kitchen. Published by the Society for Electrical Development, New York City.

Care and Operation of an Electric Rrange. Hughes Electric Heating Company, Chicago, Ill.

Also the report of the 1917 Electric Range Committee, N.E.L.A.

Electric Vehicles

In the previous sections of our report we have dealt with lighting and motor power problems, as well as the value of an electric range load. Transportation affords another wide use for electric service. Electric vehicles, both passenger and commercial types, are not new developments. Due to great improvements in the vehicles themselves, and in the batteries, motors and control apparatus, as well as to the high cost of oil and gasoline, and to the constantly decreasing cost of electrical energy to charge the batteries, the use of electric trucks is growing rapidly.

The passenger car, or as it is frequently called, the pleasure car, is no longer a costly toy. It is steadily showing itself a strong competitor to the gas car in all respects; not only in city traffic, but on country roads. Various authentic reports show runs of from 80 to 100 miles on a single charge of batteries, over hilly and none too smooth roads, and at average speeds of from 18 to 23 miles per hour. This type of car, while admittedly good for suburban or country travel, is ideal for city use, being quiet, easily controlled, always ready and extremely cheap to operate.

The "Electric," however, is at its best when used commercially.

As now manufactured, the electric truck is used extensively in practically all lines of business, predominating in:

Express Companies,
Department Stores,
Breweries,
Dairies,
Laundrys,
Undertakers,
Fire Departments,
Street Cleaning Departments,
General Trucking.

It is stated that the total value of electric trucks in the United States is approximately \$36,000,000. If the same ratio in proportion to the population were obtained, Canada should possess electric trucks to the value of about \$3,000,000. Information at hand shows that the total investment in electric trucks in the Dominion of Canada very likely does not exceed \$300,000. From the above we can conclude that the field in Canada for the sale of electric trucks is very fertile and offers great possibilities, either to the manufacturer or central station that is willing to put forth the proper amount of effort.

The principal reasons for the rapid success of the electric truck are the low up-keep and reliability. Supplementary reasons are the improvements in charging apparatus, the development of charging stations equipped with proper facilities, together with the increased capacity of storage batteries. In this connection it is interesting to note that the storage battery, as manufactured at present, possesses an average life of double that of a few years ago. The modern electric truck in city and suburban service is capable of going from 40 to 50 miles on one battery charge, a total travel per day that well satisfies the requirements of most commercial transportation. By using a spare battery this mileage may be esily doubled.

Large manufacturers and others requiring extensive trucking, or large department stores, have proved the immense value of the electric truck. Department stores in larger cities have come to depend nearly exclusively upon their electric delivery system, utilizing electric cars from 1,000 to 2,000 lbs. capacity, for their house to house delivery.

Due to the greatly congested condition of large shipping points, railroad terminals, etc., the use of trucks and tractors to pull trailers is rapidly becoming more extensive. The field for the use of these tractors is open to every central station located in a city which is an industrial or shipping centre. Nearly all factories can be profitably equipped with electric transveyors, and these do away with the handling of freight by hand trucks. The larger railroad systems are rapidly replacing the old type of hand drawn mail and baggage trucks with the modern storage battery truck, which winds its way in and out of traffic, starting and stopping instantly, and at the same time carrying more than double the load formerly possible. In these days of large profits, manufacturers are oftentimes not keen to make investments

where economy of operation is the only inducement. The modern by-word is "Speed." In order to convince the factory manager that he should use electric trucks and tractors, it is necessary, in many instances, to prove to him that their use will expedite his work. Expediency, more than Economy, is becoming the governing factor.

From the central station point of view, a battery charging load is becoming more and more desirable. The large demands for power made upon the central stations, by war orders, etc., are increasing the demand for power made upon the system without appreciably increasing the system load factor. Battery charging is naturally an off peak operation—the trucks and pleasure cars as a rule are in operation during the day and are charged during the night. Central stations should foster the use of electric trucks in every way possible. Your Committee believes that no better way can be found than for each Member Company to purchase electric trucks for their lamp and meter deliveries, as well as for carrying service materials to the job. By so doing the average central station not only can reduce its own delivery expense, but also will serve to show other prospective users that electric trucks are better in all respects than gas cars or horses for local deliveries.

In this connection it is interesting to note that one of our Member Companies report they are using six electric trucks, of various capacities, and by so doing have greatly decreased their garage expense. The same company reports that there are 160 pleasure vehicles in their territory and also 40 commercial vehicles. The income from the sale of energy to charge these batteries approximates $15,000 per year.

Other Uses of Electricity

The preceding divisions of this report have covered the more usual and more general use of electricity, but there are, however, a large number of important uses which should be discussed, and therefore they are combined under this title.

Only those uses of electricity which directly or indirectly mean a substantial increased output for the Central Station have been included, and thus a large number of uses of electricity, although important to the consumers, are eliminated, since they do not require any considerable amount of energy.

Even with this restriction there are so many uses of electricity not otherwise covered, that it seemed desirable to classify the various uses and processes brought to the attention of your Committee under several sub-headings, which designate the character of the use to which electricity is put in the various processes shown under each sub-heading.

In order to facilitate the relative importance of the various processes to the electrical industry, it also seemed desirable that some indication be given, when possible, as to the amount of power in-

volved in each, and the energy consumption per unit of product, and this data has, therefore, been included. The tabulation is necessarily rather inaccurate, and the data shown is only inserted for comparative purposes to indicate the relations between the various processes and the electrical industry.

Tabulation of "Other Uses of Electricity"

Arc Heating Processes

Product	Energy Consumption in kilowatt-hours	H.P. in use in Canada 1916-1917
Calcium Carbide	1.2 to 1.6 per lb.	75,000
Ferro Silicon	3 " 5 "	80,000
Ferro Manganese	2.5 " 4 "	1,000
Ferro Titanium	2.4 " 5 "	1,000
Ferro Nickel	5 " 7 "	1,000
Ferro Molybdenum	3 " 6 "	500
Ordinary Steel	0.3 " 0.6 "	40,000
Tool Steels	0.5 " 0.8 "	3,000
Tungsten	3 " 5 "	
Zinc	0.7 " 1.2 "	500
Nitrogen fixation		None directly

Resistance Heating Processes

Product	Energy Consumption in kilowatt-hours	H.P. in use in Canada 1916-1917
Calcining Coal (Carbon electrodes)	2.5 to 4 per lb.	4,000
Graphite		3,000
Carborundum		2,000
Bauxite melting (Chrystolon, alundum, etc.)		15,000
Spot Welders		1,000

Electrolytic Processes

Product	H.P. in use in Canada 1916-1917
Zinc	300
Copper	....
Hydrogen	1,500
Oxygen	1,500
Chlorine	....
Caustic	....

Combined Electro-Thermic and Electrolytic Processes

Product	Energy Consumption in kilowatt-hours	H.P. in use in Canada 1916-1917
Aluminum	10 to 20 per lb.	40,000
Magnesium	20 to 40 per lb.	2,000

Commercial Heating

Product	H.P. in use in Canada 1916-1917
Monotype Machines, 1 kw. per machine	....
Chemical Apparatus, various	2,000

Special applications, bake oven, industrial baking, and drying, electric furnace, wood pulp grinding.

From the foregoing tabulation it appears that some 250,000 horsepower of electrical energy is today being used in Canada for other industrial uses than those which we commonly see and hear about. This represents a rather large percentage of the total power generated in Canada, and, due to the high load factor at which this power is taken, there is really more energy taken for these purposes than would appear at first sight.

Arc Heating Processes

By far the largest amount of power used for any of the processes shown above, is consumed for arc heating, and in this sub-division calcium carbide and ferro silicon stand in the front rank. The use of arc heating in the manufacture of steel has, however, grown very rapidly, and this use bids fair to surpass even carbide and ferro silicon in its energy consumption within the next few years. For example, in 1915 there was less than 5,000 horsepower used for steel manufacture in Canada, whereas today nearly 40,000 horsepower are so used.

Experiments are being carried out at many points dealing with the production of ferro alloys other than ferro silicon, and it is quite probable that this work will lead to results requiring considerably greater amounts of power than is being taken for the production of these alloys today.

One of the arc processes which have shown great development during the last year has been the treatment of zinc ores, and present indications are that this process will be of some magnitude in the near future.

Resistance Heating

Most of the processes in which heat is generated by the passage of electricity through the materials making up the product, do not require large amounts of energy per unit of product, nor do any of the products made by such processes compare with carbide or ferro silicon on the tonnage produced per year. These processes, therefore, while important industrially, are relatively unimportant from the power company viewpoint. It should be noted, however, that these processes, which are mostly used for the manufacture of abrasive materials and electrodes, have been well developed in Canada, and have been of tremendous value in the production of munitions, as abrasives have speeded up munition production to a remarkable degree and electrodes have permitted the production of ferro silicon, which is essential to the present-day steel manufacture.

Electrolytic Processes

Processes using the electric current for plating or similar work, without using the current for heating, do not in general require large amounts of energy per unit of product, and thus the total use of

power for this type of process is relatively small, and will remain so until the tonnages produced become very large. However, the use of electricity for these processes, especially the production of electrolytic copper and zinc, is rapidly increasing, and in the near future much larger amounts of power in the aggregate will be required.

A novel use for this type of process has been the manufacture of chlorine in cotton mills and paper mills for direct use in bleaching, rather than the obtaining of bleaching agents by the use of chlorine carried in chlorinated lime.

Combined Electrolytic and Electro-Thermic Processes

When the small amount of energy required for actually plating the metal out of an electrolytic bath is increased by the amount of energy required to keep that bath molten at relatively high temperatures, the energy consumption per unit of product is very much increased over the theoretical amount required for plating only. There are two metals produced today commercially by this process, aluminum and magnesium, and the amount of power taken for this purpose is very considerable.

Commercial Heating

Due to ease of temperature control and freedom from attention, electricity is being applied today in many processes requiring nice temperature regulation, or where relatively small amounts of heat are required in inaccessible places. For example, the lead pots of monotype machines are now heated electrically, with the result that perfect slugs can be obtained at all times and the output per day from such machines materially increased. Again, certain parts of shoe-making machinery require to be heated, and it has been difficult in the past to provide for the heating of these machines when changing from steam to electric power in shoe factories. With the application of electric heat to these machines, however, this difficulty has been removed.

The chemical industries are rapidly finding uses for electric heating in those re-actions which require a constant temperature, and the input of a fixed amount of heat to the materials undergoing reaction, and this use of electricity will certainly in the future be a very important one.

Regulators

While regulators do not in themselves consume large amounts of power, they, however, when applied to electric furnaces, pulp grinding machinery and other apparatus, so increase the load factor that the energy consumption is very largely increased. Until recently it has been quite impossible to get satisfactory regulators for heavy

duty, but this problem now seems to have been solved and regulators are available for handling any commercial load.

General

The above tabulation and discussion of "Other Uses of Electricity" is far from complete, and only covers those particularly large uses of energy which seemed worthy of note, and they are set forth above in order that they may serve as an outline for discussion at the Convention, when more accurate and complete data on these and other processes will be forthcoming.

The tremendous advances made in these "Other Uses of Electricity" in the last few years, would seem to indicate that in the future by far the greatest portion of the output of electricity will be used for the types of processes covered in this portion of the report.

Respectfully submitted,

Charles T. Barnes, H. E. Randall,
W. H. McIntyre, Edmund E. Walker,
Louis W. Pratt. M. C. Gilman, Chairman.

The President: You have heard this very valuable report. There is almost more in it than we can digest in a minute. Everybody ought to take one of these home. It is almost a text book. I think the Committee is deserving of great credit for the large amount of work they have covered. They have had numerous meetings and have been untiring in their zeal to produce a report that would be of benefit to the Association.

The matter of Illumination and Commercial Report and Mr. Hyde's remarks this morning are open for discussion. I hope that you, one and all, will take advantage of the opportunity, as there is no subject more important to us.

Mr. Grier takes the Chair.

Mr. Grier: Will you permit, as I have been asked to take the Chair for a while, to endorse and confirm what Mr. McDougall has said, and I trust you will bear in mind that there are these three interesting papers to consider in the discussion which I trust now will take place upon them all.

Mr. Dion: Mr. Chairman, I have been very much interested in this very thorough and elaborate report that has just been read. It is probably, I think, the best presentation of the subject that has ever been made before this Association, and the members of the Committee are to be highly commended for the amount of attention they have given to the subject.

In connection with the paper on Illumination, which I do not propose to discuss, I would merely remark that I hope it will be possible for the Association to have it printed. There is some data that has been given to us which I would like to refer to again, and for that purpose it would be valuable to me, and to other members, I have no doubt, if it could be printed and distributed.

There is only one other point in connection with the Report of the Committee which I would like to speak on, and that is the reference to electrical vehicles. I have fully recognized for many years the great importance of that kind of load to a central station. And with the object of securing such a load we took the steps that are being recommended in that report. That is, we procured some electric trucks in order to demonstrate their efficiency and their usefulness. We spent considerable money in that way, and I am not at all satisfied with the results. In the first place, notwithstanding all that has been said and published about durability of batteries, we found in practice that, with the average driver—we did not think we could afford to keep specially expert drivers—the driver used the batteries in such a way or other conditions came in, whatever they were, notwithstanding the expert care that was given the batteries in the garage, so that we never got the results that have been published and generally spoken of, and the battery expense proved to be very high.

Another trouble is the climate. We happen to be in a region where there is considerable snow, and that applies to a good many companies represented here. We found it impossible to operate our trucks throughout the year. By the way, that applies to gasoline trucks as well as electric trucks. We found it impossible, except on the business streets, where electric railways were obliged to remove the snow, but in the side streets the accumulation of snow is such that it is impossible to operate these trucks. It does not seem practicable to lay away all your trucks and start horse transportation in the winter time and dispose of all that material in the spring or feed those horses all summer while they are doing nothing. We have compromised by having part of our work done by trucks and part of our work done by horses, and in the winter time we find it is possible to hire horses at a low rate owing to the number of trades where horses are not needed in the winter time. And we have managed to get along that way in order to utilize our trucks to the best advantage. That is the difficulty you have to reckon with in many parts of this country. And that is, as far as I have been able to see, the greatest obstacle in the way of selling these trucks to your people. They say: Why, you cannot run your trucks in the winter. There it is. You have got to confess that. And that is one reason

why so little has been done in this country in the way of obtaining a vehicle load.

There are other things in the Report which could be discussed profitably, but it is such a big document that I would like to digest it for a few days before saying anything more about it.

The Chairman: I hope some other gentlemen will follow Mr. Dion's most excellent example in giving us this account of the difficulties they have had in reference to this particular point. I should like all you, gentlemen, to bear in mind, as I try to bear in mind myself as I am sitting in the body of the hall, that perhaps the nicest compliment we can pay to any reader of a paper is to take part in the discussion following upon it. I am quite sure that numbers of you have things which you would like to utter.

Mr. Hopper, New Brunswick: Mr. Chairman and Gentlemen, I did not expect to speak on the different papers that have been read. I would like to refer to what Mr. Dion has said regarding the electric trucks. I had a very regrettable experience with electric trucks. I bought a Waverley 1,000 pound truck. I also bought a runabout for my own personal use—it cost me $3,600. We had them three years, and in those three years we bought three batteries, both for the truck and for the pleasure car—at least I bought two for the pleasure car and the company bought three for the truck. They ran three years on hard dirt roads. I would not recommend anybody to buy an electric truck or electric pleasure car for use on our dirt roads. Of course, we down east have not got any paved streets. When it was sold, the gentleman from New York who was handling this Waverly car told me, although he would not put it into the guarantee, that we could get 60 miles. I regret to say that we never could get 25 miles, either out of the truck or pleasure car, on one charge of the battery. I sold the truck for $40 two months ago, and I sold my runabout for $125. Anybody who buys an electric truck to use on dirt roads is of questionable intelligence.

Mr. Davies: While on the matter of electric trucks, it might be interesting to report the difference in running upon streets cleaned by the Tramways company when snow is on the ground and the same streets when running upon summer conditions. We gave the matter careful attention when we found our cars would not run in winter—and they do not run in winter. They may run on certain occasions but very seldom regularly. We found it took four times as much current to run on streets with the snow fairly well cleaned by the Tramways Company, as it did to run upon ordinary asphalt road. I think the last speaker is perfectly correct when he speaks about the mileage he gets out of these vehicles. We had a Bailey car, the same

type of car that used to run from New York and Albany and over to Chicago and back on one half of a charge. In fact, it would do about 90 miles on road, but we never could get more than 25 miles out of it. There is something about Canadian roads that seem to mount up the kw.h. We might as well confess it. In Montreal it is commercially impossible to sell electric trucks. We tried them, tried them from 1,000 lbs. to 5 tons, and while we keep them on the road, because they are too big an investment to lie idle, on the other hand it is pretty hard to recommend them. And until batteries become stronger and cheaper and more economical, it looks as though the electric truck proposition is doomed to failure, for other than flat, well paved streets in temperate climates.

From time to time there are salesmen who come along and tell us that we are neglecting a field that offers splendid possibilities. As you know, Mr. Edison said some four or five years ago at a New York Convention that there will be more energy sold for propelling vehicles in ten years than there was for everything else put together. I do not think that will happen in Canada. A field where the electric vehicle does work out splendidly is in the use of small industrial trucks in factories. We are getting several of these on our lines and everybody is very well pleased with them. Some of our munition manufacturers have been using them very successfully for moving shells from one place of the establishment to another.

Not a single electric truck company that has come into Montreal but has failed, and there must be a reason.

I would like to discuss the Power Sales Report It is a very excellent report; covers practically every field of work. The point of power factor is very well taken. Nowadays, with industrial loads, when people get the motor they can, not the motor they want, companies are being filled up with peak loads of low power factor, and every effort should be made to correct this.

Regarding the lighting papers, I am sorry discussion was not carried on immediately after the papers, because the discussion has got so diverse now that I don't know where to start.

Mr. Grier: I should like to say not only to Mr. Davies, but to all others, that I trust that you will not forget that the subject has embraced not only this last matter of electric practice, but also and primarily, viewing it historically, the matter of illumination, and if Mr. Davies has some other things to say in regard to illumination I trust that he will say them even though there are these other matters.

Mr. Davies: No doubt that in discussing lighting rates, power companies have to look to the lighting end of the business to revive

itself, have got to get more kw.h. per customer. No doubt about this. But the difficulty is that the central station is not in touch with the people that put in the fixtures. The average illumination of a house is absolutely controlled by some contractor or the ideas of the person that builds or buys the house. A salesman cannot very well go in and say: "That is direct lighting, terrible glare; you are going to suffer from that; you should put in one of our $25.00 indirect fixtures that will use twice as much kw.h., but in the long run your eyesight will be saved." That is the proposition you are up against. It seems to us the education necessary is the education of the contractor, and our big lighting fixture people must be got in line to quietly put the soft pedal upon direct lighting and 25c sockets, and see that people get some good glassware, semi-indirect at least. Mr. Durgin, of the Commonwealth Edison Company, last year prepared a most beautiful lecture which he termed "Lighting, a by-product or a buy product?" The idea was that we should try to sell lighting and not sell kw.h. for lighting. And it illustrated in a most beautiful manner how one could increase the kw.h. and at the same time give the customer the value for it. Showed pictures of a poor room with bright lights. One could imagine the lady of 35 to 40, perhaps just beginning to show signs of looking at her very worst, and in another picture, semi-indirect light which would make her look about 20. These things tell for the happiness of the home. If we only could get to them just at the right point we could without doubt educate the public and increase our lighting sales.

As you know, Toronto and Ottawa and other places get about 2 to 3 cents kw. for lighting. There is no doubt that most of their business is served at a loss. If people obtain prices of this description they are merely robbing the power companies. They do not do it anywhere else. They do not do it in England. You could not buy there a kw. for lighting for 2½ and 3 cents. Go down into the States and you find the average prevailing rate there about 8 to 10 cents. In Canada only we get a 2½c rate. If we cannot have reasonable rates for the time being, we will get them later on. The only thing, therefore, is to educate people so that they will use more kw.h. per kw. connected.

Mr. Grier: I think perhaps it may be interesting at this stage to make two remarks. In the first place, I now quite appreciate why Mr. McDougall, who represents the Toronto Electric Light, wanted somebody else in the chair whilst such observations as those of Mr. Davies were being made, because unquestionably it is important to lighting companies in Ontario. And secondly, I want to point out how evidently illumination has improved since the days of W. S. Gilbert when, collaborating with Sullivan. Writing of a lady who desired a youthful effect—I think she must have been quite well on

in years—he said that "she might very well pass for 43 in the dusk with the light behind her;" whereas now, from what we have heard, with the glares of the electric light she might pass for 21 in a beautifully illuminated room.

As to electric trucks, we must bear in mind that so far all arguments have been advanced against them. If there is anything to be said in their favor with due regard to our climatic conditions in the winter, I hope it will be said. I am not quite so lacking in hope as some of the speakers, simply because I am very much impressed with the capacity of men such as the electric men I see before me when they set themselves a task. Conceivably later on they will be of use. Perhaps some are of the view that already they are of service in the winter. If they are, we shall be glad to hear them. Please bear in mind that the subject ranges widely now. It includes at least this matter of electric trucks and that very interesting subject of illumination, which we heard of this morning and also this afternoon.

Mr. Winters, Bell Telephone: Not being an electrical man, but in another line of business, and listening to the paper on illumination, and the necessity, as Mr. Davies says, of selling more kw.h., it would seem to me that this Association has got to influence the architects. He talks about increasing the output for lighting purposes. You will occupy a house here in Montreal, apparently a well-finished house, everything looks outside fairly good, you go in and find if you want any light or facilities for getting light you have to spend probably $50 to $100 to provide outlets. It seems to me that the architects or the men that build the houses are the people the lighting companies have to get after, as also the sellers of the equipment, because there are many fine residences in Montreal that have not an outlet any place in the house either to attach a desk lamp or anything else to. It is lamentable. It seems to me that it is one of the points that this Association, if they are trying to improve the lighting and save the people's eyes, should at least do a little missionary work in having the people who build houses supply sufficient outlets so that the customer of the lighting company who may be supplying the kw.h. could at least utilize their product. I think that is a very important point, because the great bulk of your business I suppose in electric lighting is the same as for the telephone—it is from the average man, not from the few millionaires, and the average man will use light if he has facilities. I think the average residence is badly equipped for lighting purposes.

Mr. Hyde: Mr. Chairman and Gentlemen, if I may be excused for participating in the discussion, I want to take one or two remarks which have been made, one by Mr. Gilman and one by Mr. Davies, and link them together. Incidentally it is most interesting to me to see that lighting conditions are to be improved, as indicated by Mr. Gilman, because I think great benefit can be secured through Central

Station Sales Departments. Mr. Gilman states in his paper the fact that lighting loads are decreasing in percentage when compared with the percentage of the total load represented by the power load, and that this was due in part to a decrease in rates. He mentioned particularly that it was also due to the higher efficiency at which incandescent lamps are procurable at the present day, compared with lamp efficiencies that existed some time ago. Mr. Davies spoke of indirect lighting and referred to the aesthetic conditions which might be obtained if that method of lighting service is employed. Now, the fact of the matter is that the incandescent lamp and the aesthetic installation is the combination we should work to secure. Referring to original installations of prismatic glass reflectors with their glare, adopted because with them an 8 candle power lamp did the work of a 16 candle power, there was an excuse for the prismatic reflector. Today you have no such excuse, because the consumption of current is so small in units that are now employed that one can afford to use a 50-watt tungsten of 38 candle power instead of a 50-watt carbon of 16 candle power. If the men of the industry will take the idea of surrounding homes and other buildings with an atmosphere of charm, there will be a chance not only to display taste in conformity with each one's ideas of what is pleasing, but also an opportunity of employing color schemes that will match the draperies and lend a decorative as well as an architectural interest to the color schemes in the home. You will find it is quite possible to increase the kw.h. in residences simply because you have made each residence a place of greater charm, which is something that can be sold to the woman every time, if not to the man.

There is another little side light on this situation which I think is of interest. The average absorption factor of materials that are used on walls has more to do with the actual foot candles that are obtained for illumination than the light sources themselves. For example, if a room with a very light paper on the walls, a white ceiling and relatively light floor, whether covered with a rug or not, has its colorings darkened, 70 to 80 to 90 per cent. of the total light, depending on the color chosen, is absorbed. Now, if people want a dark room, say in Flemish, or desire to have something that conforms with any special scheme the architect has embodied in his specifications covering interior decoration of any particular environment, one can be absolutely sure that with plenty of incandescent lamps on the circuit there will be plenty of light, notwithstanding the dark finish with its high absorption. If you encourage surroundings of this kind and employ sufficient lamps, you will have greater kw.h. consumption as a result of providing light that is needed in excess of that which has been absorbed.

The President: I think each locality will vary in regard to the

problem of using isolated plants or plants temporarily not used in order to get the capacity of the installed machinery. In Toronto it works the other way. There is a great coal scarcity and famine, and the result is that all the isolated plants shut down and want Central Station power. That may not be a war condition; the war condition arising out of the coal scarcity can be traced to the war indirectly. In the meantime the Toronto Electric Light Company has been operating its steam plant, which was formerly held as a reserve plant in case of break down of transmission lines. We have installed a capacity of approximately 26,000 h.p. That plant has been operating continuously with varying loads from the first of June last. Instead of being a reserve plant, it is on load. In addition there is a turbine of 8,000 kw., installed last December. The Toronto Company, having generating plant at Niagara Falls, has taken steps to deliver every kilowatt that it is possible for them to generate. The result of that is that the Government of Ontario have accused us of stealing water from the Niagara River. We have interpreted our contract there in a way that is backed up by expert opinion. We took these opinions before we committed the awful deed, and where we are allowed to generate 125,000 h.p. at Niagara we have been getting peaks of 146,000 h.p. We did not make any bones about it. Our charts are on exhibition and inspectors from the Government see these reports continually, but Sir Adam Beck made the startling announcement at Toronto that he had caught us stealing, and that we should be put in jail. If a man tapping a gas main was subject to arrest, certainly those who stole the people's power should be committed to the same kind of confinement. Now, that was done owing to munition loads, owing to abnormal conditions our load is 50 per cent. higher than it was before the war. And not only that, but factories, especially abrasive factories, are taking large blocks of off-peak power, the only kind they can get, and every kilowatt is working. That is in spite of difficulties of getting coal, $10 a ton in Toronto for coal normally $4.50. The rates have not been changed. The rates for power in Toronto are on hydraulic basis. Now, if the war had not been the reason, certainly we would have obtained at least the cost of that power generated by steam. And I am sure that there is no company that I know of in Canada that is not using every kilowatt that is demanded of it for war purposes, and I have not heard of anybody attempting to take advantage of the situation. The munition load is not a permanent load, it is a temporary load, and from a company's standpoint, if you were to take your selfish considerations only, you would probably say: No, you cannot do it, because it means an overload on our plant; it means coal at $10. It means perhaps running a risk of our regular customers falling down in their service.

Mr. Maclachlan: I would like to revert back to the illuminating end of it, and I think that Central Stations could do a great deal in increasing their loads of illumination if they would set the example. It looks very fine in your offices. Your offices are usually well lit, but I get around behind boilers of Ontario plants, and, to say the least, a great improvement could be carried out. Now, if good illumination is good in the machine shop certainly it is good in your own power plants. And it would be a great advantage to you to be able to take the prospective machine customer into your power plant and show him up-to-date illumination. I am looking at it from the safety standpoint. I believe that good illumination would cut out a great percentage of your stumbling accidents and a number of other types of accidents from the plants.

Now, in connection with industrial lighting, I would like to ask Mr. Harrison what has been the latest practice in the use of high power illuminants in foundries? I had some work some years ago in putting in a layout in a small machine shop, and I was talking to the manager the other day after they had been using it for about four years and they claim an hour per day per man in the foundry as a saving as a result of putting in these illuminants. Before that they were using a carbon lamp, helped out by one or two arc lamps, but mostly used a direct light from the charge from the cupola.

Those are just one or two points I would like to bring out.

Mr. McDougall, Montreal: Mr. Davies made the remark that he wanted to increase the kilowatt hours for lighting. Now, it seems to me that they have been going on the wrong track, that is, most of the power companies and Central Stations have. They have been leaving it to contractor and manufacturer to do all the educational work. It is natural that manufacturer or contractor should try to sell a particular fixture. There is a biased opinion there in favor of what he is selling. The power companies are not interested in any particular fixtures, simply the type of illumination that should be used for different purposes. To increase the kilowatt hours for lighting you have to increase the standard of illumination. The standard of illumination in this country is very low. There is not one per cent. of the industrial plants that are working with anything like the efficiency that they should be under their artificial illumination. You can go into plants and find a system of illumination that was installed 15 years ago, and that is still going. They simply do not change because they do not know any better.

As an example of working the illumination from the Central Station point of view I might cite a small town I am interested in, with about 5,000 inhabitants. A year or two ago they thought that the power company was robbing them for lighting. We preached

illumination, showed them where their illumination was wrong. We have put in a new system of illumination for them with drop reflectors and proper distribution of light. Their bills are now twice as big, their output is a great deal better and they are tickled to death to pay their bills.

Mr. Ward Harrison: I may be pardoned for speaking again. There is a great deal in that statement that the contractor is interested in a particular thing that he has to sell. Now, when you get down to it, the fixture dealer to-day is the man who makes largely or assembles the metal parts. And frankly he is interested in selling them. The glassware he buys and sells again, and in many cases on small margin. And the average fixture dealer in the States, and I guess in this country, is opposed to semi-indirect lighting because even these fixtures here, which convey an appearance of richness, and all that, consist of a dollar or two worth of metal, and mostly glass.

In regard to the remark of increasing the standard of illumination as a load builder. The two things are right together. Semi-indirect lighting is a load builder. If you put up a bare lamp in this room you won't stand for half the intensity of light that you will have if you have a nice soft light like this. You can take those shades down and leave out two and you would say the room was too bright because your eye catches the brightness of the globe, and when you have soft light you want enough of it. So if you cultivate the semi-indirect fixtures you would sell twice as much energy, because the efficiency of the system is about half. You sell about half as much more because people with soft lighting burn and want to take about twice as much of it.

With regard to the industrial problem, it is plain that good lighting in the factories is of advantage as a load builder, not only in itself, but for the fact that it makes it profitable to run a plant during hours when now with poor lighting they feel they cannot afford to run on account of low production and on account of the spoiling. In other words, good lighting in the plant makes it possible to keep motors going six or eight hours more than when you have poor lighting. When you get down to the fundamental reason that industrial plants run in the day time or in the light hours and not the dark hours, it is because we have been accustomed to think it is the only time we can work. Amusements take up the evening because they think that is the only time they could not work efficiently. If you had as good light from 7 o'clock to 11 o'clock at night as you had from 7 in the morning to 3 or 4 in the afternoon, there is not any reason why in a great many plants two shifts could not be operated, because they would have their

leisure time in the middle of the day when they could use it to advantage out-doors.

Mr. Johnson, Montreal: I believe you should start at the very beginning of the trouble, which is the architects, or rather the contractors who draw their own plans and specifications. Most of the trouble is due to the fact that the smaller architect or contractor does not appreciate the importance of the electric wiring and fixtures.

It is very hard for any one except an illuminating engineer to convince an architect what is required, and that brings up the question of whether the present lighting rates will permit most companies to engage such illuminating specialists.

The work is very slow and it often takes many months before you can see what has been accomplished.

Mr. Grier: I should like to say a word with regard to this point, which is perhaps of pretty considerable interest. Amongst the activities with which I have occupied myself in recent years has been that of acting as counsel for the Ontario Association of Architects. Whilst they have not charged me to say this, I feel that I am in a position to say it with full authority, namely, that they would welcome at any time an address made to them by any representative of any electrical interest devoted to the very practical point of so devising dwelling houses and other buildings that the most efficient lighting could be installed. I now venture to assume the position of inviting such an address in the future at a time which will be most convenient to those interested; an address to be delivered by a representative of electrical interests to the Ontario Association of Architects upon the very practical point of having installed the best possible lighting system.

Mr. Dunlop: It strikes me that while considerable increase in the lighting load can be made by better methods of illumination and indirect lighting, that the most promising field we have to-day is electrical appliances; that is, heaters and toasters, etc. Under Ontario rules, and I think it is the Underwriters as well, the largest circuit you can run in a residence is 6 amperes, and most of the best current consuming devices take about 600 watts. There are some very good appliances taking over 600 watts, and you cannot put them in on any circuit in the house. It seems to me that something along the line of making provision for heavier circuits in the wiring of residences would be of very great assistance to lighting companies. You take any of the best consuming devices, toasters, etc., 600 watts, and you have a few lights loaded on the same circuit, the fuse blows and there is dissatisfaction all around. It seems to me if the Underwriters would allow of 10 ampere circuits being wired into houses, it would be of very great benefit to the electrical companies in promoting an increase of the lighting load.

The President: I understand that the restriction—I may be wrong—I understand that the restriction applies to an ordinary lamp socket, ordinary house wire. I do not understand there is any objection to wiring your houses with heavier circuits, but limited to ordinary lamp socket, about 500 watts, about the heaviest load they will allow. That is a subject that could also be very well taken up with the architects at the meeting proposed by Mr. Grier, as to wiring for dining-rooms and other places where appliances could be used; it should be ambraced at the same time as the illumination subject with the architects. After all, is not the fault entirely with the Central Station Companies themselves? How many Central Stations in Canada have a man competent to talk illumination? Is there an expert in every company who can go to an architect or go to a customer and tell him the proper methods of illumination. I do not believe that there are five per cent. of the companies who have a competent man to do that work. Now, if one salesman out of each company was selected and made competent along these lines and the company advertised that that man's services were available for use either to the architects, contractors or to individuals, factory owners or others, that the field would open up fairly readily. The National Electric Light Association have published a very useful book, a small pamphlet on the wiring of buildings and wiring of old houses, etc. The book is obtainable from the N. E. L. A. office in New York, and could be used by our member companies either to circularize their customers with or for the purpose of educating the contractors. It shows, amongst other things, if I remember correctly, the use of outlets and where they should be put in new house or old house; how simple it is to wire an old house. And with the wiring man properly in touch and co-operating with the Central Stations it is to their benefit to put in all the outlets they can get the customer to pay for. And I feel that the Central Stations are really at the bottom of the thing, and are to blame for not giving more attention to the question of illumination in educating their salesmen to talk intelligently and give proper advice to the customer. I feel that is a very important matter, and that we as Central Station men owe it to our customers to give as much trouble and pains and time to studying this illumination question and equipping our salesmen as we do about the distribution of power in factories, use of motors, etc. When you consider that the average investment per house in a service alone is probably between $5 and $10, and when you consider possibly your connected load at a residence averages half a kilowatt and that your connected load on residences per kw. is very much higher than the investment required for a power load, it shows the necessity of developing the residential revenue in order to properly carry that investment. And I feel that there is no subject

that should be given more attention by the Central Station men than this residential load of various kinds.

I am glad to see that you have taken this thing seriously, and a great many suggestions have been offered that will be of benefit. I am sure. We must not go away and forget them. It is for our own benefit that we come here, and if we do not take advantage of the thoughts of the various members we are neglecting our duty.

Now, if there is any further discussion I would like to hear it Before proceeding further, so as not to overlook it, I wish to announce that the Local Section, the Montreal Section of the N.E.L.A. have very kindly invited all delegates to a dinner tonight in the Grill Room downstairs at 7.30 p.m. Admission will be by ticket, and the members are requested to get their tickets at the desk before leaving.

Mr. Randall: In this regard I would like to tell in a few words about the installation of electricity in a group of 44 houses at Shawinigan Falls. It is a practical try-out of household load. There were 44 houses built there the last summer in a community. The whole thing was based, the electric load, on a very heavy consumption of electricity—including all the ordinary household appliances, and also hot air heaters for the spring and fall—which are essential in this country. The whole scheme was worked out carefully, using underground services with steel buried armoured cable, about a foot in the ground, and served from transformers in vaults. The installation provides 6 kw. for each house. The houses are now equipped with stoves and electric water heaters, and thus will not only demonstrate to the community the usefulness of these things but at the same time will give the company a large amount of valuable information for future reference. It will be very interesting to watch the operation of this installation because it gives one of the best means of answering the question what is the diversity factor of the electric range load. We have 44 on one circuit; we should be able to determine this.

Mr. Smith, Perth: Before this very interesting discussion is brought to a close, there is one thing I would like to ask. In Mr. Gilman's paper on page 5 it speaks, of water-heater. I would like to ask what experience members have had of the different types of heater. There is one insert heater which is being advertised very extensively at the present time, made in Seattle. There are other circulation heaters. The insert type, I understand, consumes about 500 watts. The circulation types run as high as 2 kw., or 500 watts and 2,000 watts. I would like to know if any members have had experience with the different types. It seems to me water heaters are a very desirable class of off peak business.

There is another question, I note by the daily papers that the Dominion Government are bringing in this daylight saving scheme

in Canada, to be introduced very shortly. What is the opinion of the members as to the effect it will have on the sale of electricity for lighting? Personally, I do not think it is going to make very much difference one way or the other, but we read of the great saving that has been made in England and several other countries where it has been adopted.

Mr. Randall: I think I could answer the first question in regard to the insert heaters, but there is another thing about which a great deal of uncertainty exists and which you may very well bear in mind, and that is, that a kw.h. in a heating device means about 3,400 B.t.u., no matter whether in a circulation water heater or anything else. The amount of water heated depends on how many kw.hrs. you can put in, and any water heating device on the market has an efficiency well over 90 per cent. The net result comes down to how effective your circulation system is, and second, is how many kw.hrs. you put into a certain amount of water.

The points between insert and circulation heaters—if you have an insert heater you have got to heat the entire body of water in the tank. That is, it is quite impossible to turn on the heater and at the end of an hour or two get any hot water, because the entire water would be at the same temperature. If you have a circulation water heater properly connected at the end of one or two hours you will be able to get a few inches of hot water off the top of the tank, and in many cases this will eliminate a great deal of fault-finding with the electric water heater. The main trouble people find with the electric water heater is that it is slow. It has to be slow if we can sell electricity cheap enough to compete with other means of heating water. That is, we have to use it at a high load factor. And for that reason alone—from people's viewpoint—the circulation water heater, allowing a small quantity of water to be obtained after a short period, offers advantages over the insert type, although the cost of hot water is the same in both cases.

Mr. McDougall, Montreal: In regard to this water heating, Mr. Randall covered the subject but he did not talk about radiation from the water tank. Now, a great many of those heaters are thrown out as failures because they do not lag their tanks sufficiently. Radiation from the tank is almost as great as the heat input from the heater, and, to get one of those things to work satisfactorily they have to be very carefully lagged. All the pipe has to be carefully lagged and the boiler a good thick covering over it to keep the heat in, otherwise it takes about two days to get one hot.

Mr. Dusenberry: There is a report there from the N.E.L.A. papers that I do not think everybody has heard on that very subject regarding radiation loss from water heaters when the tanks are

unlined. If you don't mind I will just read this part from it. (Reads).

The President: Are there any other gentlemen present who would like to prophecy about the effect of daylight saving?

Mr. Barnes, London: We had an experience of that in London last summer. They tried it out; it was not a success and they cut it out. During that time there has been a careful noting of the effect —our company and the Hydro—and there was 12 per cent. commercial loss to our lighting.

Mr. Davies: The fact is that we do light our offices pretty well but I think that the average lighting condition of the households of the employees is about similar to the shoemaker's boots, about the worst you can find. And so one greets with approval an innovation recently brought in by one of our member companies, in a small way, but we hope it will lead to a larger. In order to demonstrate and give first-hand information to the salesmen, one of our companies has given some of its salesmen an electric stove. The idea is, go ahead and use them and know how to talk about them properly. It seems to me that it is a very fine idea. And in the matter of lighting, I do think that the Central Station should endeavor to get the houses of their employees well lighted; perhaps take a hand in it and help them out. Because, after all is said and done, you can only start at home, and if employees of power companies have well-lighted homes their friends would soon follow suit.

I notice there is no discussion about electric ranges. It seems to me we should have a few words from those who use electric ranges.

The President: Can anybody give us any information about using electric ranges from personal experience?

Mr. Gilman: May I say a word? I have had an electric range in my residence now for approximately three years, and in that period very few elements have had to be replaced. The cost of electric cooking for our family, which consists of six—four adults and two children—averages less than $2.50 per month.

The results from the use of the stove, in our case, have been all that could be desired. The stove was delivered to our home on a Friday and placed in the hands of our maid, whom I believe had never heard of an electric range until she saw it in our kitchen. On Sunday following we had a few extra people to dinner, with a somewhat larger meal than would have been the case were only the family present, and everything came on to the table in proper condition. In this connection I would advise that the maid is a good cook, but I feel that the greatest credit is due to the stove itself.

As to the effect of range load on Central Station lines I would like to point out our operating conditions in and around Toronto, particularly out on our Kingston Road extension. To those not

familiar with Toronto, I would advise that Kingston Road leads out from the eastern section of our city, and is not served by gas. We have a single phase, 2300 volt line running along Kingston Road about 9 miles out to West Hill. The available business along Kingston Road consists in summer cottages as well as the larger type of year-round residences. We serve practically everybody that can be possibly reached from our line, and during the last 3½ or 4 years we have put on between 50 and 100 ranges, without finding it necessary to increase our primary circuits at all. It has been necessary, however, to install longer stretches of our secondary line, and in some cases to install larger pole transformers, and to also bank certain transformers. However, the individual investment per customer for electric ranges has been very low.

Mr. McDonagh, Quebec: I think I can claim to be one of the pioneers in electric cooking. I started using it in 1908 and I used it continuously for several years. But at that time I was not obliged to pay for it, so that I cannot tell what it cost to us. However, I installed an electric range in my own house in Quebec last November; that is, a proper electric range. I may say that the first apparatus I had for cooking at home was the old General Electric cabinet where each article was separate, separate oven, separate broiler, etc. Now I have a proper range at home and I can tell you something about the cost. An estimate for a family can be pretty accurately made. Average family will consume about one kw.hr. per day for each person. That worked out very accurately in my own case. Family of five we used about 5 kw.hrs. per day, and to bake we got that at about one cent per kw.hr. We also have in addition flat rate charge on the stove. We started first year under poor conditions, late in the season, and put out about 30 ranges. So far this season we have put out about 75 and we have excellent prospects of putting out about at least 50 more. On all ranges that have been put out none have been taken out with the exception of two that we took back because the customers were leaving town and we did not want to have them saddled with the ranges. It has been an absolute success in Quebec; all customers satisfied with their ranges.

The President: I think Mr. Gilman will bear me out, in Toronto we have sold approximately 200 ranges a year in the last 2½ years.

Mr. Gilman: That is conservative; put it about 750 in the last 2½ years.

The President: I know of only one range that came back, and that range was because the husband bought it without consulting the wife. They have given satisfaction in Toronto for more than one reason, but to my mind the principal reason outside of the rate is the fact that we do not consider the stove sold when it goes out of the shop. You have got to educate the people to proper use

of the range. You have got to acknowledge that it takes a little more time to boil water, have got to acknowledge they have to heat the element up first, which involves an element of time.

I remember when I put my range in; we had it I suppose about ten days, and they brought a roast of beef on the table on Sunday, and I said to my wife you have changed your butcher, and she said, "No, just the same as usual." "Well," I said, "I believe this is the first roast we have had cooked with the electric range," and she asked the maid, and the maid said, "Yes, this is the first roast of beef that we had cooked with the electric range." It was just as different as if it had been very much superior meat. I do not think that anybody that has used the electric range, barring the question of rates, as I say, would ever willingly go back to any other method of cooking. That is just my personal testimony to the electric cooking from a user's standpoint. The only trouble that we have had that I know of is that we sell an electric range and immediately the man next door and the man on the other side of the house want one too, and it means perhaps moving transformers or something of that kind, because it bunches the load to a certain extent. But the very fact of selling a range makes an agent for a future sale. And with rates on a graded basis so that normally the range load does not come on the high rate, the rates can compete with gas almost at any price. Gas in Toronto has been selling until recently at 70c a thousand feet, and considered a very low price. But we have no difficulty in selling electric ranges, and when we sell them they stay put.

Mr. Milliken: Ranges on 5c rate are not very easily sold. We have had some experience with ranges in hospitals. We have four hospitals which use nothing else but electric cooking. And one or two points came up that I think would be of interest. We did not anticipate much trouble when we put this equipment in. We thought an hospital staff would be semi-intelligent anyway. The first month in every hospital that the ranges were in the Hospital Committee got rather aghast at the size of their bills, and we followed them up very closely, and we found that despite the fact that you give them a little book such as the best range manufacturers turn out, they would not follow such instructions. The nurse would come down to the cooking room or kitchen and she would wish to heat, perhaps, water in an emergency late in the night; she would turn on the element away up to third heat and let it go to heat a small cup of water. We got around that finally by recommending to them that they just put in a small heater alongside the range. The result is that they have cut their bills, for emergency use anyway, away down. But in spite of the fact that the little red book hung up in front of them, it is quite difficult to educate them to use it properly.

would imagine it must be difficult to get a housemaid to use it properly.

Mr. Barnes, London: In the city of London, taking the two companies, 3½ per cent. of the electric lighting customers are using electric ranges—as high as any place in Canada. 320 ranges were installed in the last two years in London. The average cost of a family of four is $1.65 per month, at one cent a kw. The only range we have had returned—this man got up at the middle of the night with severe pains, cramps, and went down to the kitchen to get some hot water in a hurry. He said that he stood there, it took 5 minutes to heat the water and he figured out it was five hours judging from the pain he was suffering.

The President: Well, gentlemen, if there is no further discussion I will declare the meeting adjourned to meet tomorrow morning at 10.15 a.m.

Friday, June 8th, 1917

——On resuming at 10.30 a.m.

The President: We will commence our proceedings this morning, and before calling on the first speaker, according to our custom the President nominates a Nominating Committee, who will bring in nominations for the officers for the ensuing year, merely as nominations, which are subject to amendment by the meeting this afternoon. I nominate Mr. Woodyatt, Southern Canada Power Company, Mr. Dion, of Ottawa, Mr. Davies, of the Montreal Light, Heat & Power Company, Mr. Randall, of the Shawinigan Company, and Mr. Dunlop, of Pembroke. These gentlement, with Mr. Dion as Chairman, will bring in their report this afternoon.

The first number on the programme this morning is a talk on the Education of Salesmen Committee, Mr. MacIntyre and Mr. Haskell.

Mr. Haskell: Mr. Chairman, men of the electrical industry,—I notice that on the programme my committee is called Education of Salesmen Committee—but that has recently been changed to Education Committee, giving it a wider scope and not restricting it to the education of salesmen. The Canadian representatives on that Committee are Mr. MacIntyre, of Ottawa, and myself. I am sorry that Mr. MacIntyre is not able to be here today because I had looked upon him to make the report, with perhaps a few remarks from me concerning my own section.

Canada, for this work, is divided by the Ottawa River. Mr. MacIntyre looks after the Province of Ontario and the Western Provinces; I look after the Province of Quebec and the Eastern Provinces. This work is carried on to a great extent from headquarters, and we are here to aid the member companies in any way possible in establishing educational courses among the men of the member companies.

Mr. Muldaur has pointed out to you wherein men are the principal assets of member companies; without the men and their knowledge of the electrical industry and practice the industry could not go on, of course. And in these times, when I might say the best men are going to the front, and only those men who are absolutely indispensable to the member companies are staying at home, new men are having to be drafted into the service. Now, most of these new men are not technically trained, and have not had wide experience in the electrical industry; therefore, it is necessary for the member companies to educate them as expeditiously and as thoroughly as possible. Some of the companies are fortunate in being located near technical institutions where their men can have the advantage of lecture courses that are offered, either evenings or during the day. But I believe the greater number of the member companies are situated at a distance from these institutions, and therefore have to depend on correspondence courses. The two courses, the course in commercial engineering, and the course in practical electricity, offered by the N. E. L. A., are very thorough and are not too technical. Any man with average intelligence can get a great deal of information and education from them. At the present time, in Ontario and the West there are reported to be four member companies whose employees are taking these courses.

In Quebec and the Eastern Provinces 24 men have been enrolled. At the present time there are 19 men pursuing these courses; 17 men in one company and one man in each of two other companies. With the organization of the Montreal Companies' Section of N. E. L. A., of which you have heard, there is provided an Educational Committee under the Chairmanship of Mr. Randall, and we expect that during the next year the educational work of the Association will be advanced very materially through the efforts of that Committee. Member companies who are not in these Sections will have to work as separate units, and I would suggest that one man in each company be appointed to look after this work. I would suggest that perhaps the Secretary of your company be appointed to look up the courses and get all the information possible. I will be glad to correspond with anyone interested in the courses, and I am sure that Mr. MacIntyre will be willing to do the same thing; in fact, we have been doing it all the year in our districts—so that this work can be pushed to the fullest extent. This seems to be a time when this work should be pushed intensively because of the large number of men that have to be taken into the industry on account of the vacancies caused by enlistments.

These courses after July first will be restricted to class B members. Up to the present time they have been available to any employee of Class A or anyone who had the endorsement of an executive of a Class A member. But after July 1st, as mentioned by Mr. Mul-

daur, it has been found necessary to restrict this service because of the high cost of printing and supplies.

I do not feel that it is an injustice to the N. E. L. A. if member companies are allowed to subscribe non Class B members in their employ to these courses before the 1st of July. It sounds a little like a bargain store offer: "Get in early before the price goes up," and all that sort of thing, but I feel it is not doing injustice to the N. E. L. A. to offer this to member companies, for the reason that once a man has enjoyed the benefits of the courses offered by the N. E. L. A. he will be only too glad to become a Class B member, and in that way the N. E. L. A. will receive its due.

. I have here some of these prospectuses of the two courses. You have all received them, both from headquarters in Chicago and from Mr. MacIntyre or myself during the last year, but I find that most of us need frequent reminders; we receive circulars when not in the mood for looking at them, or perhaps they get lost in the mail, or get sidetracked in the office. I hope you are in the mood this morning to look these over and consider them seriously, because the Committee is working hard to give good service to the company members, and I am sure that we in the C. E. A. have a great debt of gratitude to pay to the N. E. L. A. for the service we get in return for the small fees paid.

Respectfully submitted,

L. C. Haskell.

The President: I hope you take seriously what Mr. Haskell has said . If these courses were not available, there are a great many of our employees who would spend a great deal of time fruitlessly, and probably not obtain nearly the same results as they would get from one of these courses. There is no use in inducing our members to subscribe to these courses unless some supervision is given to see that they are followed up, and that they pursue their course as far as possible through to the end. I understand that the correspondence schools, as a rule, make their money from people who drop out and pay their charges and do not follow the thing up, so that they do not have the work to do that is necessary in the pupil who writes on examination papers, etc. Now, this course is not going to be the slightest bit of good unless somebody supervises and sees that the men really take an earnest interest in it. As I said once before here, McGill University is a beautiful building, and that sort of thing, but no good unless you take advantage of it. You cannot absorb any atmosphere by walking by it, and any kind of study requires constant concentration and persistent effort.

I believe we have present with us today a gentleman who attended the first Convention of this Association. I think it would be a great deal of pleasure to hear from him. I refer to Mr. Burran, of the

Quebec Railway Company. If he is here we would be glad to have a few words from him.

Mr. Burran: I don't know what I would have to say. I think you have mistaken me for Mr. Dion. Mr. Dion generally speaks on that subject. Looking through the gathering, there is a lack of faces of those that were at the original meeting. The only one I can recognize today is Mr. Dion. I thank you for calling on me.

Mr. Maclachlan: Could I speak in regard to the education features? I refer to the question of the returned soldiers. There are a number of men coming back from the front that came from public utility companies, and they are coming back in some maimed shape. A lineman may come back without a leg or may be without an arm and will have to be educated into some other phase of the work. I think this education feature could be very well carried on with the work as being cerried out by the Military Hospitals Commission. In Toronto we have been able to do something in arranging for courses of apprenticeship, either 3, 6 or 12 months, for the returned soldiers. That is principally in the manufacturing end, but we hope to also include the public utility companies. While the returned soldier is being trained in one of these courses he receives pay from the Government and a certain amount of allowance for his wife and children. I think that this Association could do a great good to itself and a great benefit to the country at large and to the returned soldiers if they could arrange in some way to take the course of instruction designed to use the previous experience of these returned soldiers and develop them into useful citizens and respected members of the different public utility companies. The Executive might be able to do something in the coming year to work out something along that line. I just want to put that before you.

The President: Any further comment on the Education of Salesmen Report? If not, we will proceed to the next number.

We are very fortunate in having with us today a man who is known from one end of the country to the other as probably our most prominent engineer—I refer to the reader of the next paper, Mr. Julian C. Smith, who will talk to us for a while on Energy Distribution, Present and Prospective:

Mr. Julian C. Smith: Although in these days our minds and hearts are full of the questions brought up by war conditions, nevertheless, we must recognize that these are not normal times, and that some day, when the war is finished and victory won, we will get back to conditions which represent normal development in our various enterprises, and it is to emphasize these conditions that I have written the few pages which I am about to present.

Energy Distribution—Present and Prospective

In the few minutes which have been allotted to me, I wish to bring to your attention some figures which are now a matter of record, showing the growth in the use of enectric energy, and the result which it is having and will continue to have, on the development of electric stations.

As you know, the use of power began in the mining industry in the eighteen hundreds; it was as late as 1840 or 1850 before the development of steam engines had reached any considerable size, and from that time on the development has been extremely rapid.

Naturally, the first development was for each different user of power to install his own equipment, this was in fact practically the only thing which could be done, as the sizes of the prime movers were small, and there was no means of transmitting power from one station to another except by means of belts, rope drives, etc.

About 1880 electric power first began to be used, and ten years later the first alternating current devices began to appear. From 1890 on to the present time, in a space of 27 years, there has been a continuous development on an increasing scale.

Total power demands

The total amount of power, excluding railways and steamships, used in the United States at periods of the census taking, are given in the following table:—

Year	H.P.
1870	2,461,000
1880	3,617,000
1890	6,315,000
1900	15,200,000
1910	23,300,000
1915	30,000,000

The population of the United States has increased very considerably in this time, but the following table gives the amount of power used under the same conditions, that is, exclusive of transportation and animal power.

Year	H.P. Per Capita
1870	.064
1880	.072
1890	.10
1900	.20
1910	.25
1915	.30

I have used the figures for the United States because they are more readily available, and illustrate the same conditions which exist throughout the entire civilized world, that is, that there has been an increased use of power per capita, and that this increase is going on at a high rate year by year.

The following list shows the total kilowatt hours used per capita

per year as supplied by the electric service companies for all purposes, except railways:—

	K.wHr. Per Capita
Buffalo General Electric	585
P. S. E. Co., New Jersey	180
N. Y. Edison, Brooklyn, U. L. & P. Co.	225
Philadelphia	250
Pittsburg	500
Cleveland	400
Boston	350
Minneapolis	450
St. Louis	400
Rochester	450
Toronto	700
Montreal	738
Quebec	200
Entire United States	230
Niagara Falls, N.Y.	33000
Shawinigan Falls, P.Q.	41000
Three Rivers, P.Q.	3400

In broad lines this indicates that mankind has become more and more dependent upon the use of energy derived from waterpowers or steam plants, and with the data at hand we can make a fairly reasonable prediction as to what the conditions are going to be in five or ten years to come. It has only been within the last ten years that the average householder could utilize the power of any kind in small units for various purposes in connection with his house or small industry.

Development Through Three Stages

Thus the development has passed through three stages already:—

1st. The development of small power units driven by steam, which were set up in the individual factories of the power users.

2nd. The concentration of these units in large units of power, and the consequent concentration of the factory into such single large units.

3rd. The development of the power business as a separate enterprise, and the distribution of this power primarily for power purposes to different industries.

We now seem to be reaching the fourth stage, and that is, the continued concentration of the power development in large units linked together for purposes of reliability, and the distribution of this power both in large units and in small units to each individual who requires power for any purpose.

To-day in the United States and Canada, in those places where normal industrial life exists, the kilowatt hours used per year per capita amount to about 500. Of this amount 400 kw.hrs. are used for factory purposes, outside of dwelling houses or residences of individuals, and 100 kw.hrs. are used for housekeeping purposes, including principally light, and to a lesser extent heat and motive power.

Electric Cooking and Small Accessories

With the increased use of the small accessories and almost certain development of the electric cooking in the near future, we may readily look forward to a condition of affairs in five or ten years, when the demand for electric power for the individual, that is, leaving aside the industrial or factory use, will increase from the present amount of 100 kw.hrs. to 300 kw.hrs. per capita per annum, or an increase as you see of 200 per cent. At the same time, the industrial use is bound to increase, and there is every probability that in ten years from to-day, the use of electric energy will amount to more than twice as much as is used at the present time. This does not mean that every customer is going to take twice as much as he is now taking, but it does men that on the average, over a considerable territory, located favorably for manufacturing, that the increased use of power is going on at a very high rate.

The Manufacture and Distribution of Power

The natural question arises as to what may be expected in the manufacture of power and the distribution of power, and this Association is vitally interested in the proper solution of this problem.

As regards the manufacture of power, comparatively little time can be spent in this paper. The development of power by means of water power stations has reached such a high point of efficiency that very little can be hoped for in this regard. The efforts of our engineers and designers for the next few years, must be devoted to those features of the problem of hydraulic power development, which are involved in the reduction of costs.

The financing of these enterprises must also be improved, so that the total cost of the hydraulic power development can be brought down to more reasonable figures, everything considered. The government authorities can assist in this matter by preventing the duplication of lines and systems and by the proper control of construction work, so that competitive systems cannot be constructed solely for the purpose of stock jobbing operations or for political benefits. It is inevitable in such cases that finally the burden of the increased expenditure must be carried by the population served, with the consequent result that the cost of the service rendered is increased.

The proper control of rates by the government authorities, coupled with protection against competition and the assistance of the government in working out the true economic conditions in the development of these enterprises is, I am sure, the desideratum earnestly hoped for by the members of this Association.

Wild promises made by people who have had little experience in the building and distribution of electric power, that power can be generated for a few dollars per horse power, and delivered to isolated farm houses or small communities, at prices very much below

those current at the present time, only cloud the situation and postpone the proper solution of these problems.

We may some day see the time when practically everyone will obtain electric power as readily as they now obtain telephone service, or the service of good roads, but these problems cannot be solved without due regard to the factors involved, and the sooner that everyone realizes that such factors do exist, the closer we may arrive at a solution of one of the most difficult problems which now exists in the sale of electric power in small units.

Cost Estimates

A large hydro electric power station, financed under good market conditions, and protected against the hazard of intense competition, may be constructed in these days for about \$100 per horse power, where the natural conditions are favorable. Usually such a power station is located at considerable distance from its market, and transmission lines are required. Such transmission lines vary, of course, tremendously in cost, depending on the distance, the amount of power to be transmitted, the character of the line, etc., but it would be a fair estimate to assume that such a line can be constructed for, say, \$50 per h.p. This will deliver power from the hydraulic power stations to reasonably large communities at a capital cost of \$150 per h.p. in the shape of high voltage power. This power must be stepped down; must be fed into a distribution system at perhaps 12,000 volts, must be again stepped down to 2200 volts, and fed into the usual distribution system which supplies the individual customer.

The cost of this distribution system again is difficult to estimate, except in individual cases, but it might be stated that the 12,000 volt system will cost \$50 per h.p. with its transformers, switches, etc., and the low tension or 2200 volt system, with its transformers and low voltage conductors will cost anywhere from \$75 per h.p. up to \$150 per h.p.

Thus the total cost of delivering power from the hydro electric power station to small consumers located in towns of from 2,000 to 3,000 inhabitants, amounts up to \$300, and sometimes considerably in excess of this figure.

It should be borne in mind that this represents the actual investment of money, and that if the rate of interest is based on 6 per cent. value of money, that the consumer must pay \$18 per h.p. based on his maximum demand, to cover the fixed charges on the investment involved. To this amount should be added the operating costs, which, of course, vary materially, but in the case of small customers would probably be upwards of \$10 per h.p., and again there must be added items of insurance and depreciation, amounting to at least 5 per cent. more on the total investment, or \$15, making the total cost \$43 per h.p. on the maximum demand. Nothing is added

in for the actual cost of the power, or the profit. Assuming that all of these items combined represent $5.00 per h.p., the total cost is then $48 per h.p.

The load factor is very small on most of this type of business, and consequently the rate per kilowatt hour must be made high, with a guarantee of a certain definite return, if the business is to carry itself.

I realize that the figures given above are open to very considerable debate, but even if the figures are modified considerably, the final result will in most cases arrive at a high figure.

This demonstrates what I have stated above, that one of the most serious problems facing any company engaged in the distribution of electric power, is the problem of selling power to the small customer where the density of business is small. As the average customer increases his use of power by taking on accessories, doing his cooking by electricity, the conditions may be benefitted somewhat, although unfortunately a good deal of new business which will doubtless come on, has a comparatively poor load factor, and in many cases laps over the present lighting peaks.

Summary

In conclusion, I would sum up all I have stated above very simply:

1. That we are in the midst of an enormous extension in electric power systems, and we may look forward to doubling the sale of electric energy in the next ten years. A good portion of the doubling will no doubt be in the large users of power, including perhaps the railways, but there will be a very large amount of increased power sold to individuals, due to the fact that the demand for each household using power is going to increase, and the use per capita from this cause alone, will represent a very great number of kilowatt hours per annum.

2. The problems of generation and transmission are fairly well solved.

3. The problems involved in the organization of companies, in the reduction of expenses by the elimination of competition, and in the better co-operation of the government control, must all be met and solved successfully within the next few years, if the growth we see coming is to be realized in its greatest extent.

4. One of the most difficult problems is the sale of electric energy in small quantities in isolated communities. This is of great importance because of the large number of people interested, and whose demands for such service must be taken into consideration. The problem must be solved by careful study and investigation, and by the recognition by all parties concerned that there are serious difficulties involved which necessarily cause the price of electric service de-

livered under these conditions to be high. The solution of these problems can only be satisfactorily arrived at by the co-operation of all of us, including the customer to whom we sell the power.

The President: I think it is a good thing that we came down into this larger hall today. After a paper of that kind we all naturally want to throw our chest out and require space to do it in.

We have a gentleman present today who some three or four years ago attended an N. E. L. A. Convention and was so inspired by the things that went on there, and being of well-known literary standing, that he wrote several articles in connection with the future of electricity, one of which was published in Harpers Magazine, called "100 years hence." I think it is fitting that I call upon him to make a few remarks as to his views in connection with the prospective use of electric current at this time. I will call on Mr. Alan Sullivan, our Secretary.

Mr. Alan Sullivan: Mr. President and gentlemen, is was my privilege two or three years ago to spend some time with several of the fathers of the electrical industry of the United States. And it is quite true that a very vivid impression was left, at any rate, on my own mind by those interviews. It was interesting also to note that while the interpretation put by the various gentlemen on their own activities in the electrical industry naturally varied with their individual interests, the general trend of the conclusions to which they had come was really very similar. There seemed to be a general feeling that so far as the mechanical production and manufacture of power was concerned, in many respects there was very little left that could be humanly done to improve the conditions already in use. The one exception to that view was Mr. Charles Brush, and Mr. Charles Brush put it roughly this way, speaking at the time of the generation of electrical energy by the use of coal, to which method, of course, a great part of the United States is confined, owing to the topographical character of the country. He said: "What happens is this—coal is mined out of the ground; it is then hauled 500 miles and upward by the expenditure of more coal. This coal is then burned under boilers and the resultant efficiency expressed in terms of electrical energy developed is perhaps 8 to 10 per cent. of the original potential value of coal in heat units. So that regarding it from that point of view some 90 per cent. of possible work, of total theoretical value, is dissipated and dissipated at an expense." I asked him, "What is your view of the future with regard to these areas in which hydro-electrical energy is impossible?" He said: "I see it rather in this way—that the time is not very far distant when very large internal combustion engines will be built at the mouth of coal pits; gas will be there generated and used in these engines, the cost of manufacture

of which will be greatly decreased. Instead of hauling coal all over the country we will distribute the energy." He felt that this would take a considerable time to arrive at, but by process of eliminating those factors which on the face of them are undesirable and wasteful, he thought that the ultimate outcome was perfectly obvious.

Mr. Edison also felt that very great achievements had been arrived at in the method of generation of energy, and he thought that the future of the electrical industry lay in the chemical laboratory, plus skilled observation. And I was very much interested yesterday in listening to Mr. Howe, whose exposition on electro-chemical products coincided extremely well with Mr. Edison's remarks.

Prof. Thomson also felt the same with regard to the generation of energy. And he thought that no very new development would be made in the method of production, but that the duty of the future lay along the lines of refinement and economy in its use.

Mr. Frank Sprague expressed himself strongly upon the misconception held by a very large part of the public with regard to the electrifying of railways, and pointed out that when people spoke of the electrification, we will say, of transcontinental railways, they spoke absolutely with no knowledge of the governing facts involved. He felt that when large power stations could be so intimately linked with the requirements of dense populations and their load could be equally and equitably distributed, there was an excellent chance for the electrification of certain sections of railway within areas not far distant from that unit. But to speak of the electrification of transcontinental lines which were forced to cover very large and thinly populated areas, he pointed out that the capital expense involved would make the thing, at any rate at the present time, out of the question.

I had a rather vivid talk with Dr. Charles Steinmetz which terminated in a slight disagreement, but this disagreement was not an electrical one. Dr. Steinmetz' conclusions are that the future of the electrical business lies in the ability to deal in energy largely as one deals in groceries. A man wants a dollar's worth of energy, he must have it; and have it delivered at once where he desires it. It will put the man who wishes to live in the country in a position to do his work in the city. A man whose business lies in the city will be in a position to live outside that city if he so wishes. Dr. Steinmetz also spoke of the value of electrical transportation to the eastern farmer. The eastern farmer, he pointed out, had worked his lands to death, and then found that he could not compete with the unexhausted lands of the West which required no fertilization. The result was that the cost of working the eastern farm became so high that he could not produce. But with electric transportation and modern fertilizers he expected that the eastern farmer would regain his former position as an important producer.

The whole trend of the various conversations which I had the pleasure of taking part in was that the unexpected had been almost eliminated. The one exception to that was Dr. Graham Bell, who made the statement that he wished to go on record as saying that a development of electrical energy would shortly take place which was hitherto undreamed of by the world. Well, I have not seen Dr. Bell since, nor have I had the opportunity of any correspondence with him, but it certainly still clings vividly in my imagination, because Dr. Bell is not the man to commit himself in a remark of that nature unless he was very very sure indeed.

The general impression with which I came away was that these men were not in the business for profit. I have seldom been so impressed by the sincerity, the modesty and the generosity of people as in talking to that eminent group. They felt they had no secrets which they wished to hide. They descended to the intellectual level of their visitor with grace and readiness.

And altogether it struck me that the reactive effect of electrical energy on the man who gives of himself faithfully and consistently, is a very valuable human and personal asset. And it does seem that those who have made their position through these means, as have these gentlemen, are indeed worthy of whatever respect and honor we can pay them.

The President: I am only sorry to say that we did not have this excellent paper of Mr. Smith's in our hands prior to assembling here, as I am sure a great many of you would have noted numerous points that you would like to bring up. This is a paper that excites our imagination, and the statistics quoted are of great interest. I would like to have an ample discussion, however. No doubt a good many of you have made mental notes at least of some points, and it is an opportunity to obtain information on various phases of our business, as we have Mr. Smith with us. I think that we should have a very animated discussion on this paper. The paper is open now for general discussion.

Mr. Hyde: Mr. Chairman, may I be pardoned for participating in this discussion. The activities of Central Stations have brought about tremendous commercial industries, of which the company by which I am employed is one, and we are compelled on our part to foresee what will be future practices so that our activities will be largely permanent by adapting ourselves to conditions that are the result of Central Station lighting and power progress. The following items, I think, are not inappropriate to the subject at hand.

Clerk Maxwell made some measurements of solar energy, it being supposed that there might be power development secured from

the sun's radiation that could be employed in districts geographically remote from the common sources of energy that we now employ. His figure of 150 h.p. per square mile seemed absolutely inadequate, so that source had to be disregarded if quantity or volume were to be expected.

Another suggestion that impressed me was the enormous amount of energy which can be transmitted without means of transmission lines, as evidenced by the wireless system, and that there might be a future in which energy in radiation form or wave motion could be transmitted through ether, or in the lower strata where ether and air are found together, and that central energy stations might be constructed by which it would be possible to direct the full force of the energy developed in directions that were selective rather than general, as at present is the case. There has been no place to my knowledge where this has been accomplished successfully. It may be that the author of the paper can give us some enlightening information regarding the situation.

There is a source of power which seems to be applicable, but which also is in the state of experimental development, and which has not attained anything that looks like a commercial result. I have reference to the explosive qualities of many chemicals in combinations, such as dynamite, nitro-glycerine, etc. I have noticed mention of an explosive of tremendous strength referred to recently in the papers, whereby instantaneously there is let loose an enormous amount of power, but as power unharnessed. There seems then to be a possibility of devices being invented by means of which these explosive chemicals can be drawn on as requirements demand so that the power developed will be delivered over a period of time of considerable length, rather than expending its whole force within a fraction of a second. I had a statement brought to my attention where it was said that one gallon of nitro-glycerine properly used, and the power which it can exert extended over time as needed, would be sufficient to take the Lusitania, which was in existence at the time the statement was made, across the ocean and back again. That may be an exaggerated statement—I am not an authority for it—but it is at least interesting as indicating the enormous power which is concentrated in a gallon of explosive.

It may be these remarks will secure from those more technical and more experienced men present controverting evidence that will set aside any false impressions, but I certainly think there may be something in the development of combustion engines which will utilize chemical forces rather than leaving us altogether dependent upon either water power or fuel.

Mr. Julian C. Smith: The last speaker raised a number of points that

extend over a very wide range of engineering subjects, and which might be discussed over a very extended period. However, he made some statements which are not correct in fact.

With regard to ultimate transmission of energy by ether waves, this is, of course, a possibility. Today one cannot say very much about the probability. From knowledge that does exist and speaking now, not from my own knowledge, but from what I have read of articles written by men who are expert in this subject, it would appear just now that there is not very much hope, at least for a long time to come, of concentration in one direction of large amounts of energy from a source of radiated energy by ther waves.

As regards the use of other materials for development of power, however, the last speaker made a statement which is not correct. Very few chemical compounds, among them nitro-glycerine, dynamite or any of those other explosives, really contain as much energy as a pound of coal. Nitro-glycerine or dynamite can be burned under stove or boiler without producing any more energy or as much energy as the equivalent amount of coal or oil or of gasoline. I am speaking now entirely from memory when I say the well-known figure for coal is your 13,000 or 14,000 B.T.U. per pound for high grade coal. High grade gasoline is around 20,000, and the highest figures which we have amongst the elements which we know is hydrogen, and that contains somewhere about 50,000 or 60,000 B.T.U. per pound. But a pound of hydrogen necessarily represents a very considerable mass and a very considerable amount, for the simple reason that hydrogen is one of the lightest elements there is, and, in fact, is the lightest with the exception of helium. What the figure for the energy content of helium is I do not know, but if there is progress to be made along these lines it probably will be more by the utilization of the elements which we know today rather than by going backwards in a sense and trying to use explosives.

The last speaker referred to the employment of combustion engines in the use of explosives. You may not be aware that the first type of engines which were developed of this sort were developed with the idea of using explosives as their source of energy. Powder was exploded in the cylinders of these engines for the purpose of driving the engine. As soon as the theory was well developed and the amount of true energy in B.T.U. was ascertained, the fundamental facts and theories governing the use of heat engines showed absolutely that that was the wrong track, and conditions developed along the present lines.

Mr. Sullivan raised a very interesting point in connection with the large amount of energy available from fuel. Unfortunately that statement taken by itself is one that is apt to mislead a great many people. When one considers that statement on its face, indicating that

only 10 per cent. in ordinary engines and perhaps as much as 30 per cent. under best conditions is available from the fuel burned under a boiler, there comes to the imagination the idea that there is here a great field for future development. But when you consider there are certain well-known limitations, then you reach the conclusion that the ultimate limit of temperature which can be used in heat engines is the temperature of the material that you are handling. In other words, no heat engine that we can conceive of today could be operated above a red heat. If you get a cylinder of a gas engine to operate at red heat, you have got somewhere near the limit of capability that we can see today. And it is not possible to conceive of heat engines of the type we are using today, using anything like the 100 per cent. of energy that is contained in fuel. There may be developments through the chemical means by which a direct conversion of potential energy can be changed from the low frequency heat wave into an electric wave, but as yet the mass requirements are such that enormous quantities of material have to be used to develop the energy.

In making a statement regarding enormous potential energy, one should keep fairly in mind that potenial energy in fuel to the extent of 100 per cent. is not going to be available. And with that in mind I make this statement, without having made calculations, but I should think that the total energy that could be developed is not much more than twice what we will say we are getting today.

Mr. Dion: Mr. Chairman, those members of the Association who are responsible for the programme of this meeting are, I think, to be congratulated on the very high plane of the papers and reports that have been submitted to us. In that respect the contribution of Mr. Smith stands very high. I do not think that Mr. Smith is at all too optimistic, or that we can be too optimistic as to future requirements of power in this country. And while we may dream of future sources of power, at present not utilized, I think it may be stated that for a good many years to come we must rely in this country on hydraulic development as the main source of power. I do not want to be taken as speaking against the habit of dreaming as to future possibilities, because it is only by such dreaming that human progress can be accomplished. But while we are dreaming we must not lose sight of the practical things that we have at hand today. In this connection I think Mr. Smith has struck the keynote of the situation when he speaks of the protection that power companies and investors need in their future operations. It is extremely painful to see the trend of events in certain sections of this country in connection with this matter. You all know the situation in Ontario. I cannot help thinking that the few gentlemen that got together some years ago in Ontario to express their dissatisfaction with the condition of things,

prices at which power was obtainable, etc., that if those men had approached the existing companies then and proposed to them that they should submit to government control and regulation rather than have competitive systems instituted, these companies might have agreed and a great deal of trouble to investors would have been avoided. Possibly, on account of obstinancy on both sides, this was not accomplished and the situation has become such in Ontario that there seems to be no relief for the people who have placed their money in electrical enterprises. Now, while it may be too late in Ontario, it is not too late in other provinces. I think the efforts of those engaged in the industry, the men whose money is placed therein, should be directed by organization towards the developing, in the remaining provinces of the Dominion, a condition whereby duplicate investments would be avoided—clear economical waste, of course—and whereby investors would be protected in their holdings by such legislation as would prevent competition and would at the same time protect the public against extortionate demands by rate regulation as well as regulation of investment on the part of the companies. Such a state of things is so reasonable, is so logical that it seems everybody but some socialists and some legislators clearly understand it. And there should be complete organization on the part of all parties interested towards obtaining what is in force today in a majority of the States of the American Union in the way of government control and regulation rather than free competition, which destroys investment.

Mr. Fee, Ottawa: Do the electrical men view with any degree of alarm the fact that our wooded areas are gradually becoming depleted through fire loss and the cutting down of the same for lumber? Forests have a decided influence over water powers, and that being the case we cannot begin too soon to look ahead and to emulate the example of the older countries in Europe, where re-forestration has been for years carried on with splendid results. It seems to me that this is a very important matter, and that as governments exist to carry out the wishes of the people, we cannot too soon join hands with other interested parties in our country, to have our Government pursue the most energetic policy in this regard. To stimulate your interest and to familiarize yourselves with this, I would recommend the members joining the Canadian Forestry Association in Ottawa. This costs only one dollar a year, and a monthly magazine is issued which is very readable.

When the statements of the different sources of power were made I did not hear one mentioned—that of the tides of the sea. Experiments have been tried, I believe, but I presume have not been attended with success.

Mr. Milliken: In the discussion of this question of what is going

to happen in the future, the most immediate problem from the steam end has two aspects, one of which we pursue very diligently in trying to prove the efficiency of everything from the shovel almost up to the switchboard, which might be called waste in fuel, and we frequently neglect the fuel waste. Looking at it from that angle there are two propositions that strike me, and I have been fortunate enough to be quite closely connected with them—and that is the utilization of fuel. The Dominion Coal Company in one of their new power stations have a presumably successful installation of the Bettington boiler, which is somewhat along the line of an improved type of the Wickes boiler. That is, to my mind, one line of work which is being done today which may make the steam generation of power a much different proposition as regards the hydro-electric game than it is today. I understand there is a more improved way of using powdered fuel in operation in one of the middle Western States which bids fair to be a complete success.

We certainly have been using up a very valuable inheritance. We operate, for instance, a 21-mile interurban line; part of our roadbed is ballasted with slack coal and tailings. Now, that same grade of coal is being used today. A much inferior quality of tailings and waste is being used today in the Bettington boiler.

We hear in water powers about the natural white coal going to waste year after year, but I have never seen any statistics about waste in coal. There is just about as much steam producing black coal or its equivalent going to waste of which but a very small portion of people think.

Mr. Peterson, Bell Telephone: I would like to say a few words in reference to a paper which was read on Energy Distribution, both Present and Future. The phase of the situation which I would like to touch on is what this means to systems for the communication of intelligence such as telephone and telegraph systems. Up to a few years ago the average telephone man paid little attention to the development work being done by power industries, and under certain circumstances much engineering and development work was forced on the telephone and telegraph companies in order to compete or take care of the situation involved. This was due to interferences where these high tension systems paralleled communication circuits. It is unfortunate that where these two systems come together in parallel, say in a highway, there is but one of the two that is affected by the other. It is generally understood that the power people are not affected electrically by the presence of telephone and telegraph systems. And owing to the fact that it has been only the telephone and telegraph systems that have been affected, it has been up to them to take the initiative and start something with a view to reduce

interferences which has been in the past and which undoubtedly will be in the future a large problem which must be solved.

As you probably know, there has been much development work done in the States with a view to getting down to rock bottom of the causes of these interferences, and in trying to get some methods to avoid or reduce them to a condition which will allow these telephone circuits to be used.

To the last paper I listened with interest. The telephone engineer will be required to keep in touch with all proposed transmission lines and make a study of each individual case, with a view to reducing interferences.

There are two items which I wish to speak of—one of which is co-operation. It has been found—I won't go into the technical situation of this at all because I believe I can bring out my point in another way—as a result of development work done in the last few years, that there have been obtained certain definite plans for taking care of interference and it has been found that not only will changes and additions be made in the telephone systems, but there must be some work done on the power systems in order that the telephone and telegraph systems will not be upset by the presence of power circuits. There is, of course, one way of getting out of all this trouble, and that is, to avoid any parallelisms that occur. Where there is a choice of schemes whereby the power people can avoid paralleling telephone and telegraph lines it will be of great help. In this case we have at present telegraph companies throughout the continent paralleling for some hundreds of miles with power circuits; some of one voltage and some of another, and some of different types, etc., which means that the telephone engineer has not only to make a study of his own system, but he has also to make a study of others. And it would be a great help to the telephone companies that if anyone of the companies are to build a transmission line and find that they must parallel a trunk line telegraph system, that much labor will be reduced if this matter is brought to the attention of telephone companies. As to the Bell Telephone Company of Canada, I am sure that they will be more than glad, in order to avoid future trouble on both sides, to take it in hand at the time that the development is proposed.

I might say that the principles which underlie the causes of these troubles have now been very well understood. Not over three years ago this subject was very vague indeed. It was a cut and try method on both the part of the telephone company and telegraph company as to what to do. But to-day we have fortunately received the experience of other companies and now are in a position to fairly well take care of the situation provided certain work is done. The goal that we aim at is to make the relations within the territory such that the telephone

and telegraph companies' circuits will be conserved as though the power company were not there.

I want to say a few more words regarding these disturbances which will, no doubt, clear up some doubt in the minds of some who have made any study of the subject. The interference received is not generally due to the frequency being 60 cycles or 20 cycles, but apparently it is difficult to design generators and transformers that will eliminate the introduction of certain harmonics, and it is these harmonics that cause trouble to the telephone systems. There has been in the last two years considerable attention paid to the particular design of generators with a view to eliminating these little ripples, as you may call them, that occur. The matter has been taken up with large manufacturing companies in the States with a view to minimizing the creation of these particular waves. Undoubtedly the waves themselves are not in general either of any disadvantage or advantage to the power people, and there are on all systems, more or less, a certain amount of these small ripples that do occur. Their intensities are usually very small, so that they do not hurt the power lines. Occasionally there may be a case of a certain individual harmonic that will cause some trouble. We have methods for determining these frequencies; we have methods of installing certain apparatus both in the telephone and telegraph systems and power system which has a tendency to neutralize their effect on both systems. There is an unfortunate element in this affair which we cannot disregard, because it is the natural law of electrical magnetism. On that account forces created on telephone-telegraph systems must be so disposed along the line that they so to speak neutralize themselves. There are also certain actions of transformers which have a great tendency to create disturbances.

I hope what I say is not out of line with the discussion on this paper, but I want to point out what intercommunication of intelligence varying systems must have; that we cannot ignore development work, but must follow it up because it is impossible at all times to avoid coming in contact in parallelisms with the power people. Another side, a non-electrical one, must be taken care of. I mean the physical hazard.

In closing I might say that we have met with considerable success and we hope in the future that when parallellings do occur we will be in a position to take care of them provided we get some first hand information regarding where the power people are going to place their circuits. Throughout Canada there has been an immense development of power lines, and I speak particularly of those having feeders from 30,000 up to 60,000 volts, which parallel through our entire system. We must look forward in order to keep our business going, must try to make studies of these things and try to

reduce interference to a condition that will permit the successful use of the telephone and telegraph systems.

The President: I am sure the points raised by Mr. Peterson will meet with sympathetic hearing by all power men. I have no solution to offer at present, not being a technical man, other than I would recommend to the incoming Executive Committee that they appoint a special committee on line construction and that this Line Construction Committee include a member of the Bell Telephone Company, who can bring in a report next year, and co-operate in the meantime, to attempt to eliminate the objections raised by Mr. Peterson. I think that is about the only way we can handle that at present.

Any further discussion? If there is no further discussion, the time is passing. I wish on your behalf to thank Mr. Smith for his very able paper and to assure him that it is appreciated by the Association.

I now have much pleasure in calling upon Mr. P. Ackerman to read a paper on Selective Relay Protection for A. C. Main Transmission Lines and Distribution Systems.

——Mr. A. A. Dion takes the Chair.

Mr. P. Ackerman:

Instantaneous Selective Relay Protection for A. C. Transmission and Distributing Systems

The rapid growth of A. C. transmission and distributing systems, making the supply of thousands of customers with important loads depend on a few transmission wires exposed to all kinds of atmospheric and accidental interferences, has brought the importance of a proper relay protection clearer to our mind.

The original idea of using relays for protection of apparatus from overheating due to limited overload conditions has been dropped, at least as far as main systems are concerned, leaving the watching for overload conditions to the operator or providing special signal apparatus to call the attention of the operator.

Relays are now entirely considered as protecting devices for sectionalizing short circuits, without interrupting the rest of the system; in other words, they shall protect the system from unnecessary interruptions.

To accomplish this in the most effective way the system should be provided with relay schemes which will disconnect instantaneously and selectively any faulty part. Instantaneous action of the relays will assure the least power arc destruction to the apparatus at fault and will cause the shortest possible voltage disturbance on the system, thus saving synchronous load from falling out of step.

Selective action will assure the disconnection of the faulty apparatus without interruption whatever if the apparatus was operated in parallel with others, or with local interruption only to the load connected to the faulty apparatus if it is an independent feeder.

Little progress has been made on this continent towards accomplishing this perfect state of protection. The reasons for this slow progress are manifold.

The Merz-Price system, so extensively and satisfactorily used in England, is not so well suited for our conditions of chiefly overhead transmission and has, probably for this reason, not been able to make any great headway.

Too much energy has been concentrated by the relay manufacturer on improving the old principles applied particularly in trying to improve the reverse current relay, overlooking the fact that the principle was unable to act correctly under all short circuit conditions.

The problem of effective relay protection is extremely complex and requires a very intimate knowledge of the whole system. It happens, however, that the manufacturer developing and supplying the relays is lacking in this knowledge and the operating man who would know his system completely is lacking the time to work out these problems. The result of this is that standardized relays are applied which at some places may give fair satisfaction while at others they may be fully unsatisfactory.

Because of the uncertainty of most of the proposed schemes a natural suspicion has developed against any new scheme with the result that the operator prefers to operate entirely unprotected rather than depend on an uncertain relay protection.

These are probably some of the chief causes why the development of effective relay schemes has made very slow progress, and why the possibilities of effective instantaneous selective protection of whole transmission systems has been overlooked, although effective schemes have been devised in individual cases within the last few years.

A System of Time-Limit Relays

Present-day practice of relay protection of a.c. systems is to provide a system of time limit relays, providing the farthest distant feeders with the smallest time element and increasing this time element progressively toward the generating station, the object of this graded time adjustment being to allow faulty far-distant feeders to sectionalize from the main system without extending the interruption to any larger section than the one affected.

On large systems the highest time settings reached toward the generating station may easily be as high as two seconds definite time, which means that short circuits occurring in the main system may hang on for this length of time, before being cleared, with the

result that usually the synchronous load of the whole system drops out of step and the power arc destruction on insulators, line cables or underground cables becomes excessive. Also, with graded time protection only, a smaller or larger part of the system will always be interrupted, as no selective disconnection of faulty parts, being operated in parallel with others, can be expected.

Selective Disconnection

Selective disconnection of faulty parallel operated lines has been attempted with more or less success with the combination of time limit overload relays at the generating end of the lines and reverse current relays at the receiving end. This combination has always failed to be absolutely dependable, chiefly due to the inherent weakness of the principle applied to the reverse current relay. Practically all of them are built on a wattmeter principle, requiring an interaction between current and potential coil to cause the movement which closes the relay contacts.

With short circuits nearest to the receiving station, our potential is liable to be pulled down to zero, and the power factor of any short circuit current is very low. A wattmeter cannot move without voltage and moves slowly only with low voltage and lowe power factor. A reverse current relay based on this same principle cannot possibly act differently and it is quite evident, therefore, why it was found so unreliable when used for selective protection of parallel lines.

It is true, considerable efforts have been made to improve and correct this inherent weakness, and relays are now obtainable which are operative down to 1 to 2 per cent. voltage and in which the effect of the low power factor has been corrected and a marked improvement in their effectiveness has no doubt been established, yet the fact remains that they will be unable to take care of all possible short circuit conditions from one end of the line to the other one.

Furthermore, their combination with time limit relays at the generating end causes generally the line short to hang on the system sufficiently long to cause the dropping out of step of most of the synchronous load.

From this it will be realized that effective dependable and selectively acting parallel line protection can only be expected by applying a principle which does not require a doubtful potention element and which does not require time limit relays at the generating station end of the lines.

For many years past it has been realized that other principles are available to cut out faulty parallel lines, but so far only very limited use has been made of them.

Instantaneous Protection

The idea of instantaneous selective protection is not new and has been developed to a very great state of perfection by Messrs.

Merz & Price in England. Their principle can be applied to any piece of apparatus; it bases on the fact that the current flowing into an apparatus and out of it is always the same in magnitude and direction as long as the apparatus is perfect; the instant a fault develops in the apparatus this current balance between inflow and outflow is disturbed and the difference between those two currents is made use of to actuate a relay and disconnect the faulty apparatus.

For generator, transformer and short cable protection this principle is very satisfactory and can hardly be improved and deserves a more extensive use on this continent than it has found in the past.

For long cable runs and overhead lines the Merz-Price principle is not desirable because of the need of pilot wires required between the two ends of the lines. In this case parallel lines are preferably protected by making use of the fact that the currents of the same phase of parallel lines are balanced normally, but unbalanced in case of a short within any one of the parallel lines.

This principle depends entirely on current elements and is accordingly absolutely effective for any kind of short circuits. It can be applied in many different ways; the difficulty, however, lies in the development of a practical form which makes it foolproof and does not require any attention on the part of the operator.

This principle has been successfully used for the protection of the 60,000 volt lines Niagara Falls-Toronto of the Toronto Power Company, a parallel feeder protection being in service since January, 1916, and a double line protection since April, 1917. Both protective schemes have cleared to date 34 line shorts without a single failure. The following data give an idea of the different causes of the shorts and the effect on the load of the system.

A. Line Shorts Cleared by Relay Protection Tabulated According to Causes

Cause	Number of Shorts
Lightning	10
Sleet and wind	4
Insulator failure	15
(Chiefly old insulators in operation since 1906)	
Line tests (to prove effectiveness of relays)	4
Unknown	1
Total	34

B. Effect on Load

Amount of load lost	Number of Shorts
None	26
Less than 20 per cent.	5
20 to 50 per cent.	3

A similar instantaneous selective protection for the Toronto 12,000 volt underground distribution between the terminal station and the sub-stations will be completed shortly.

It is felt that after the completion of this protection the main transmission and distributing system should become almost immune to total or large partial interruptions, except in case of bus-bar shorts, switch failures or operator's mistakes.

The graded time protection has still been maintained to a limited extent; its function in the main system, however, has changed to a kind of standby to cut out whole sub-stations in case of sub-station bus-bar shorts or should, for any reason, the instantaneous relays or switches fail to act. The time protection should, however, hardly ever have to come into action.

Not every system is as favorable in its layout to permit a perfection of protection which we believe to have reached, but by properly harmonizing design, operating needs and selection of protective devices it should be possible to develop an effective instantaneous selective protection for almost any system.

The question of protection, however, cannot possibly be standardized as it is too largely dependent on local conditions, and for this reason no details of the schemes applied are given, the intention of the paper being merely to show the great prospect of operating improvements by the use of relays based on current balance.

Mr. Dion: You have heard a very interesting paper on a subject of very great interest to technical men. There has been a great deal of attention given to the matter of relay protection, devices for the protection of apparatus and prevention of unnecessary interruptions to the service. There is no subject of such anxiety to engineers or one more likely to cause embarrassment in the design of any given system. The paper is open for discussion.

Mr. Julian C. Smith: Mr. Chairman, I listened with a great deal of pleasure and profit to Mr. Ackerman's paper, and I think it deserves the careful consideration of all engineers interested in the design and operation of power companies. There is no question but with the tremendous expansion which is now taking place in the distribution of electrical power, that the necessity arises of designing these systems in the beginning so that adequate protection can be applied. In the old days of designs the only thought was to put up a transmission line provided with transformers that had comparatively little relation to the rest of the system. Today I think all of us have reached a point where we are now endeavoring to tie these new extensions into the system as a whole, either by forming ring systems or by forming parallel lines, so that in case of trouble on one particular line the service will either be not interrupted at all or, if it is inter-

rupted, the interruption will be limited to a relatively small zone.

Mr. Ackerman has been able to apply his talents fortunately in a system that was, by reason of its condition, relatively easy, I may say, to work on. The fact that there are three or four parallel circuits between Niagara Falls and Toronto makes it much easier to apply such a selective system than when there are only two circuits. And, again, when he is dealing with a ring system it is necessarily more difficult to apply the principle. Nevertheless, the principle Mr. Ackerman raises—that is, the principle of using selective action by the unbalanced current conditions caused by the short circuit does appeal to me to be a very proper principle to work on, and I have no doubt Mr. Ackerman, with the experience he has had, should develop and may bring before this society within the next year or two, some very great improvements in this essential.

Mr. Dion: I am sure Mr. Ackerman will be pleased to answer any questions if you want further details. If there is no further discussion we have reached the end of our programme for this morning. I will ask Mr. McDougall to resume the chair in case he has anything to say before.

——Mr. McDougall resumes the Chair.

The President: I am sure I express your feelings when I say we thank Mr. Ackerman for his paper. It was gotten up on very short notice. Your Committee in looking over prospective programme discovered that the Committee Reports and prospective speakers were largely covering commercial subjects. And in order to cater to the diversified taste of our members we induced Mr. Julian Smith and Mr. Ackerman and Mr. Howe to give us papers that would interest the engineers and technical men of our member companies. This notice was given, I believe, last Monday, so you can appreciate that the time was short in which to prepare the admirable papers we have listened to.

As regards Mr. Ackerman's work in Toronto, I personally know that several of the methods of installations recommended and installed by him were opposed by the operating engineers. The results have thoroughly vindicated Mr. Ackerman's judgment and knowledge and have been approved and appreciated by those who formerly opposed the idea.

I think Mr. Ackerman probably told you that another year would give him more data on which to write a paper or draw conclusions from it. I also understand that this relay protection is largely a question of local adaptation, cannot be laid down in a general way as adaptable to all systems without taking into consideration the local conditions.

If there is any discussion of Mr. Ackerman's paper we would be

glad to hear it, as I am sure that every technical man is interested in this development of the scientific end of our business.

There being no discussion I will ask the Nominating Committee whom I mentioned, Mr. Dion, Mr. Davies, Mr. Randall, Mr. Woodyatt and Mr. Dunlop to meet the Secretary at the close of this session so as to have a report for the Class A meeting this afternoon.

There being nothing further we will declare the meeting adjourned until 2.30 p.m. this afternoon, and I hope you will all be here to hear Mr. Davies' excellent report on Rate Research Committee Work. This is a subject that everybody should be interested in as there are some theories in it that should provoke discussion.

——Meeting adjourned.

——On resuming at 2.30 p.m.

The President: We will now hear Mr. Davies' report.

Report of Committee on Rate Research

Mr. Davies: Mr. Chairman and Gentlemen, this paper is not exactly the same as the one of which you have the multigraph copy. Some changes have been made since it was first submitted.

This Committee, which is the couterpart of the N.E.L.A. Committee of the same name, was created by the President and Executive Committee to bear a similar relation to the C. E. A. as that which the National Committee fills to the parent body of the N.E.L.A.

This direction opens up a large field of endeavor for our Committee, and it is difficult to make a start on any particular line of research until this field has been surveyed and plotted and thorough consideration given to the whole question so that the elements which will prove of immediate value can be investigated first and those which deal only with gradations and niceties left until the main considerations are given a general study.

The question of rates is perhaps the most important of all questions, since without profitable rates no company can progress, and without equitable rates no company can be of full service to the community which it supplies.

Rates again are the primary cause of friction between the public and the central station company, and, if complicated, do more to cause criticism, just or unjust, than any other contact point between the parties thereto.

Rate-making since the beginning of the commercial supply of electricity has proceeded almost at the whim of the central station manager; if a company is profitable it is taken as a criterion that the rates are well chosen; if otherwise the reverse holds. The pendulum has swung from flat rates to meter rates, from meter rates to

mixed rates, and from mixed rates to rates which require an accountant to render and a comptroller to check—it might well be said, "In the making of rates there is no end."

Lastly, before we proceed to outline the field of endeavor laid bare to this Committee, let it be postulated that the growth of business absolutely depends on well-chosen rates, as without attractive rates business comes but slowly.

Attached hereto is a chart which endeavors to show in a readily appreciated form the possible elaboration of a rate research study. It is quite possible that some of the branches of study may overlap the work of other committees, but this Committee deems it advisable to indicate all factors required to enable anyone interested in rate making to proceed with an investigation.

It will be seen that the field is a very large one, and that each and every branch and leaf on the rate research tree is capable of research and investigation.

In view of this variety and the short time at the disposal of the Committee, we feel that we can only suggest the most pressing topics for investigation and comment briefly on the problems thus chosen. Taking the main branches in order, we find the following the most important:

Contracts—Legal—Consequential Damages

The progress of the art is not such that it is possible to provide against interruptions; the claims of customers for damages through loss or deterioration of product, which damages bear no relation to the price of services, can have no basis in equity nor should any responsibility for consequential damages be considered by companies under any condition whatsoever.

Competitive sources of power are just as liable to interruption, and in accepting service a customer also accepts any risk of interruption which is present. A standard form of non-liability clause should be included in all contracts, and the following is a form which is used by one of the larger companies:—"The company does not guarantee a constant supply of electricity and shall not be liable for any damages to the consumer in consequence of its failure to supply electricity at any time or times."

Rate Forms—Standardization

It would be a good thing if rate forms for similar classes of service could be of the same type in various parts of the country. All of us are familiar with the difficulties experienced in dealing with a new customer from another part of the country who is accustomed to a rate form which is not included in the rates available; a difference in price is not difficult to explain as the price of many things vary with location, wages, etc., but a totally different form of rate

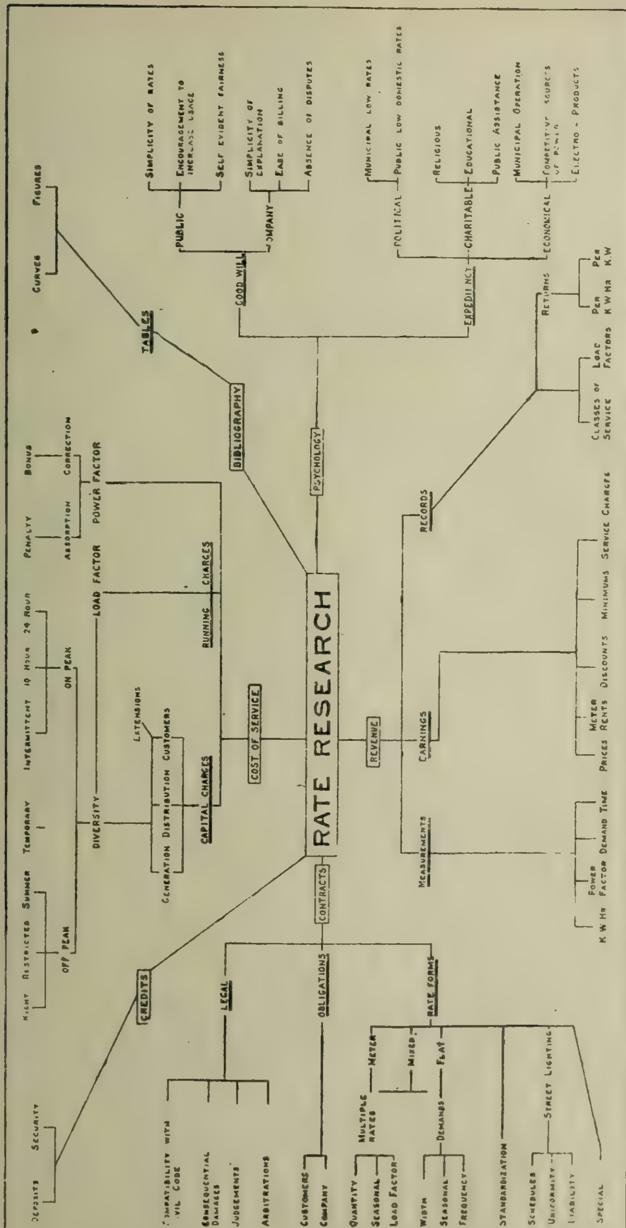


Chart Accompanying Report of Committee on Rate Research

not easily understood by customers, is more difficult to explain, and creates a feeling of distrust which no explanation will eradicate.

There is at the present time an absolute lack of uniformity in the definition of what constitutes a "Horse Power"; in some cases a twenty minute average load is taken, in others a five minute average load, in some cases three demands per month, in others a single demand.

Demands

The width of demand taken, especially in flate rate contracts, is a determining factor in the revenue obtained from any service, and while in some cases, such as water pumping, refrigeration, flour milling, textile mill driving, street lighting, and to a lesser degree shell machining on large installations, the demand taken over a short period does not differ much from a demand taken over a fairly long period; in other cases, such as hydraulic presses, air compressors, rock crushers, mine haulages, etc., the demand is a constantly fluctuating one, reaching maxima of short duration with regular frequency, which if taken over a long period would not represent the capacity which has to be furnished to supply such demands.

Again, in other cases, such as elevators, electric furnaces, and many industrial loads, the extreme maxima may be reached infrequently and be of short duration when demanded. Generally speaking, the central station company has the right to regard the question from two points of view. First, the reserve capacity for overloads existing in the plants supplying the demand; second, the amount of plant which would have to be installed by the customer to take care of the demand if the load were carried by an independent plant.

The Committee proposes to collect data on the question of the characteristics of the demands taken by different industries which central stations supply, anticipating that such information may be of use to the members in providing data upon which rates can be based.

It has been suggested that steady loads are best rated upon long demand intervals, and fluctuating loads upon short intervals, but while on the face of it this may appear fair, it is open to the objection that the steady load with no diversity is rewarded, and the fluctuating load with high diversity is penalized.

Undoubtedly where water storage is possible or where the system is large compared to the demand to be rated, this solution is open to criticism and the Committee would be glad of full discussion of this question.

Another solution is to abandon flat rates altogether and substitute mixed rates with a flat rate portion of the charge producing only 30 to 50 per cent. of the total revenue; under these conditions the question of peak period can be more easily standardized, as a short peak period will not unduly penalize any customer, and a low load

factor, i.e., of high diversity, will be taken care of equitably by the meter rate portion of the charge.

Revenue—Measurements

Instruments for the determination of demand have been slow of development, and this Committee has no doubt that all companies suffer from lack of same.

The instruments required can be divided into two groups—those required for small loads, say up to 50 horse power, and those required for larger loads.

The requirements for small loads are low first cost and low operating costs—for large loads companies are warranted in obtaining high class instruments and employing specially trained help for watching and calibrating the instruments used.

While there are now obtainable a few instruments for small loads filling the above requirements, they are all of a type which register current only, and leave a record of only one demand without indicating the time at which the demand occurred. There is without doubt a great need of an instrument for the small load, and the lack of same has forced most companies to the expedient of depending on haphazard tests or of taking the rating or some fraction of the rating of the apparatus connected as the basis of charge for the flat rate portion of the account.

For the large customers many excellent graphic meters are obtainable; these, however, are open to the objection that a fluctuating load cannot be accurately integrated, and also the record is very bulky and the instruments require continual attention.

There have been developed recently graphic meters on the Merz principle which show the kw.h. used during successive intervals. A record for a week showing the kw.h. used every fifteen minutes can be obtained on an eight-inch chart or on a strip chart 24 inches long, and the necessity of integration is done away with, while the accuracy of the instruments is wholly dependent on the integrating meter by which it is operated.

The attention of members is directed to the report of the Meter Committee, which gives full data on these meters. Even here, however, there is one thing lacking on the record, which is power factor; and there is still room for an instrument which will graphically record the kw.hrs. and kv.a. hrs. on the same chart or on synchronized charts. An instrument of the kw. demand graphic type, with a second pen charting the kv.a., has been produced, and a description of it will be found in the report of the Meter Committee of the N.E.L.A., 1917, not yet published. The meter is quite elaborate, but its production is a step in the right direction.

Cost of Service—Temporary Loads

The tremendous demands created by the war on the central station have produced a problem in rate making which requires careful consideration, while the central station has a patriotic duty to perform in trying to accommodate all loads offered; nevertheless, where such demands require the installation of generating plant and lines which are liable to be idle when the demands are lessened, and when such extensions can only be purchased at supernormal prices, and will be depreciated from 50 to 70 per cent. when prices become normal again, it is obviously the part of the customer to pay either in the rate or as a separate item at least the depreciation, plus the interest on such capital as will have to be carried idle for the period after the demand is withdrawn until normal business again requires such extensions.

If this is not done companies are liable to be faced with lower earnings and higher fixed charges after the war. Broadly speaking, the rate should cover the investment required in all cases, plus a fair profit, and if this cannot be obtained the business will be well refused.

Psychology

This division of Rate Research is one which may appear hardly a function of a Committee of an electrical organization, but the modern trend of thought is all toward the scientific study of cause and effect and some problems of Rate Research can hardly be classified under another head.

Good Will

There can hardly be any question that simplicity of rate form is the sine qua non of rate making, but still, from time to time complicated rate forms are evolved which give the customer the feeling of taking a step into the dark unknown when he signs his name to the contract form. Technicians and experts, too, often make rates which are far beyond the comprehension of customers, and while such forms are possible of application between expert and expert, they savor too much of the methods attributed to autocracy for dealings between public service corporations and their customers.

Expediency

This again is a question which will bear discussion and one which should not be hidden under a bushel.

The central station has a duty in the community to promote mutual growth, and if the granting of a low rate to an industry will foster that industry, bringing in its train increased population and wealth to the community, and incidentally new customers for the company from whom they can obtain their regular profit, then the central station company can afford to serve that industry at almost cost price to the mutual well being.

Again, where the cost of energy is the critical factor in the success of the enterprise, i.e., electro product manufacture—a low rate is justifiable, but where the cost of energy is an incidental cost in a highly profitable industry the central station has a right to a good profit in the same way that it is axiomatic that good wages are the legitimate reward of successful employees in a successful company. In a sense a central station company is also an employee of all users of its product, and as such is entitled to some share in the profits.

Charitable

With reference to low rates for hospitals, schools, etc., it is an understood thing that no one wishes to make an ordinary profit out of such institutions, inasmuch as they represent the manifest desires of the community to promote its well being; so therefore, there should be no disposition on the part of the stockholder per se to take a profit indirectly through his holdings in a central station company.

The Committee trusts that a full discussion will be given by members on the questions raised, and would appreciate direction by the members as to what problems members have which they would like the Committee to investigate.

Respectfully submitted,

P. T. Davies, Chairman.
Jas. B. Woodyatt.
H. E. Randall.
A. A. Dion.
M. C. Gilman.

The President: Despite the many important papers that we have heard, there is probably nothing so vital to the interests of the companies as their rates. Many companies adopt a rate because somebody else has it, or because they think they can operate as cheaply as anybody else, and therefore the others' rate is thought to be adequate without proper study of all local conditions. Papers of this kind open a field for thought that each one of us should not overlook.

I think we owe some debt of gratitude to our representative on this N.E.L.A. Committee for being of use in blocking the iniquitous proposition of making an arbitrary one-hour peak standard demand. It is, to my mind, as unfair as anything that could be conceived. Companies with mixed loads very easily realize what this paper points out, that a compressor load should not be classed the same as a chemical load. The company has to suffer the fluctuating demand, whatever it may be, and under the hour ruling would get nothing for 50 per cent. of the actual demand that the customer would be obliged to provide equipment for if he was furnishing his own power.

There are so many points brought up here in this paper that might be of interest to you. I am not going to discuss the paper

in detail because that is your function. I have to apologize to you for taking so much of your time in expressing my personal views on some of these papers. I have tried to do that with the idea of encouraging further discussion. I am not used to presiding at meetings of this kind and consequently sometimes forget the role I have assumed. I will ask now for a liberal discussion on this important paper, and the meeting is open for that purpose.

Mr. Randall: There are a few ideas in rates which I have been looking into recently, considering rates as an abstract proposition. It is, perhaps, somewhat new to think of rates from a purely mathematical viewpoint, but it came about like this: When we consider rates existing five years ago throughout Canada we will find that with respect to their present-day values that they are very much higher. Now, this is particularly noticeable in Ontario at the present time, and it occurred to me that there must be some relation between maximum net returns and lighting rates. That is, it is reasonable to suppose that if you had a rate, say, of one cent a kw. hour for lighting you would have a certain net return. If you had five cents it would be another net return, and if, say, 20c. it would be another net return. Now, if you draw a curve of net return against rate, there must be some point at which that curve would be a maximum. In the past there has been a lot of rate making on the basis of what the other fellow does. "Well, the rates there are 7c. Oh, we should get 8c." But if you look at it abstractly there seems to be some point under certain conditions where the stimulation of business due to low rate per kw. hour, will more than overbalance the high profits that are obtainable under a very much higher rate under which the use will be more or less restricted. I took the trouble to plot a curve or two curves, in fact—one curve showing net return per kw. hour, and another curve showing kw. hours per year per capita on lighting circuits; plotting these indiscriminately for various towns against the average rate per kw. hour. Of course, such a curve necessarily will be a rather uncertain thing. But it is interesting to note that these curves show a definite shape. Both as to maximum net return per kw. hour and maximum use of kw. hours per capita for about 200 towns plotted, the maximum net results and maximum rates occur at a rate of somewhat between 4½c and 6½c net.

This is simply an idea which I would like to bring up for discussion, because it seems to me logical that there must be some definite relation between rate and maximum net return.

Mr. Gilman: As a member of this Committee in name only, I wish to take this opportunity of congratulating Mr. Davies on his very fine paper dealing with such an important subject—a subject to which I am afraid too many of us have given too little attention. In Ontario, as a previous speaker has intimated, we have naturally been

more or less guided (if you can call it such) as regards the rate question, by the actions of our municipal competitor.

The President: Coercion.

Mr. Gilman: That is a better word. Our competitors have adopted what is undoubtedly an extremely scientific rate.

The President: In theory.

Mr. Gilman: Theoretically, and like a good many other things, their power rate in theory is alright, but in practice it is quite difficult to satisfactorily arrange for the proper working out. Their power rate is a combination, as Mr. Davies has mentioned, of a flat rate portion plus operating charges depended on each customer's load factor. "The nigger in the wood pile" in Toronto has been the manner of applying the rate, due to their inequitable basis of determining the maximum demand. The demand has been taken in almost every manner and in any fashion that could possibly be thought of—it has even been guessed at—in fact anything has been used that would get the business. At the outset their policy was to take the greatest ten minute average demand for the month. This did not give the customer quite enough benefit to enable them to take away business from us. They accordingly went a bit further by stretching out the period of their average maximum demand to 15 minutes and later to 20 minutes. To-day they are billing customers on a 20 minute sustained maximum demand. We have found certain cases in the past where by means of graphic meters, their customer's demand has been shown,, for instance at 100 h.p., and yet the customer has continued to receive bills on a basis of 80 h.p. You will certainly agree that such methods are inequitable.

For the past four years our power schedules have been practically the same in form as the Hydro, with this exception. We do not feel that the sustained maximum demand is a proper basis, and even at the expense of losing certain business we have consistently maintained that our customers should be billed on an integrated basis of demand.

In order to get away from the discussion incident to the question of demand, so as to make conditions easier for our salesmen, and to help our revenue as well (possibly I have these reversed in their order as regards importance) we are considering what may be a retrograde step. We are figuring on bringing out a power rate which will be based on the connected load or a function of the connected load rather than on the maximum demand.

We have had a certain amount of experience with such a rate, as our business for about three years was taken under such a rate. At that time we found out it worked very well, but for certain reasons we thought it best to alter the basis to the measured maximum demand. As stated above we now feel it may be better to go back to the other basis.

The idea will be for us to keep an accurate record of the customer's connected load, with due regard to the fact that a multiplicity of motors in a manufacturing establishment will cause a different maximum demand than as if the load was handled by one motor. Our percentage maximum demand will be graded accordingly. We feel from past experience that such a basis will be amply safe, and are able to count upon the demand taken by the percentage method as being higher than the measured maximum demand.

As Mr. Davies has mentioned in his paper, it is very difficult, in fact practically impossible, for Central Stations to satisfactorily measure the maximum demand of the smaller customers. We cannot afford to buy the instruments that are available at present for the work—they are too expensive. My reason in mentioning our proposed percentage method is simply to illustrate a possible means out of this difficulty.

The President: On the method of measuring demand, a certain gentleman from a large company said to me last night that one of his testing inspectors came into his office one morning and he put down on the table in cash $300. My friend said, "What about this?" "Why," the Inspector said, "a customer gave me that this morning. I was in testing his demand." My friend said, "What are you going to do about it?" "Why, I am going to take it back to him. I want to show you what we are up against." Now, that is one phase of the testing of demands. Another phase is, the cost of the inspection and the uncertainty of it. Highly trained men, especially meter men, are very difficult to get, especially at the present time. They are more or less expensive, and a company such as ours having about 26,000 customers, possibly about 10,000 power customers—to test those demands requires able men who cannot be bribed, cannot be fooled on operation, etc. It seems an equation as to the value of those men going once in three or four months to a customer and making a test or in taking an arbitrary demand such as Mr. Gilman has referred to and doing away with the inspection other than connected load inspection. It is simpler, of course, to make a connected load inspection than it is to make test. That is one object we have in view in thinking of this method in arriving at demand. We have not adopted it yet, and may not adopt it. But in calculating results on a percentage basis such as suggested I do not mind saying that what we have suggested is for any load under 100 h.p., first 20 h.p. to be at 90 per cent. and 60 per cent. on the balance. We have figured that out over a large number of cases of actual outside demands, and we find that works out at pretty good average. And if, after a long experience of testing, we can get a demand that is fair without the trouble of testing, without submitting our inspectors to temptation and all that sort of thing,

and the customer will accept it, surely we should curtail our expenses and adopt it.

That is just in explanation of some of the reasons we have been considering. The competitor referred to by Mr. Gilman has been even worse than he has intimated. That is, these inspectors would go to our customer and without any test at all would say: "How much demand are the Toronto Electric Light Company charging you on?" And the customer will produce his bills, show him demand, say, of 40 h.p., and Hydro canvasser will say: "You could not possibly have a demand of that kind; we will take it at 30 h.p." Now, we assaulted them in the papers, we spent a lot of money on white paper, and came out with one announcement starting off something like this: "Do you stand in with the Hydro salesman? Have you a pull with the Hydro-Electric Commission of Ontario? If so, are you being discriminated against or is your demand on which you are billed the same as others?" etc.—to create a feeling of unrest in the minds of customers that they were not getting an even divy with the other customers. The reason we adopted those tactics, after three years suffering all kinds of injustice, was simply because of the methods that they adopted, and when they had a surplus of $1,500 on 1915 year's operations on a gross income of a million and a half dollars they reduced their rates 20 per cent. That was a little too much; it got our goat, as the saying is. And it was quite evident that they were trying to put us out of business. Instead of that our business has grown. The people demand service. If they do not get it they are not satisfied. We have exerted every effort towards making our service indispensable to the customer, and have up until this year ignored every method they have adopted, but as this announcement came out, as I say, of 20 per cent. reduction on their rates with an announced surplus of $1,500, we decided that we would adopt aggressive methods. We lost no friends through it. In fact, we made friends. Lots of people telephoned us and said: "Go for them." It was quite interesting while it lasted.

Mr. Randall: I just want to add another word to what I was saying a few moments ago, that high rate does not necessarily mean high net return. It has been interesting in some of the American States where Commissions, after investigations, have ordered lighting rates reduced, but after having lighting rates reduced they did not get what they wanted—that is, to reduce net returns to the company. The reduction of lighting rates actually increased the net returns in many cases. It has been very noticeable in several cases where rate reductions have been ordered by commissions that these reductions have actually increased the net return of the company.

Mr. Gilman: I do not remember in reading Mr. Davies' paper as to whether or not definite recommendation was made with relation

to the standardizing of our power contracts. Was it recommended that this be given attention by a later committee?

Mr. Davies: Yes.

The President: Col. Street, have you anything to say in regard to this important subject?

Mr. Street: I think not, Mr. Chairman.

Mr. Maclachlan: Some years ago, when I was more intimately connected with public utility work than now, we were going into the question of rate research very thoroughly, and we found that no real survey of a town had been made to find out the varioius diversity factors between the residential consumer, his transformer, and between transformers and stations. We carried out some experiments in three towns, varying from about 2,000 inhabitants up to about 18,000 inhabitants on an actual survey, measuring the houses both for rooms, lamps, cubical contents, etc., and carrying it back over three years' revenue. And you will find, I think, that the most equitable rate for using a demand meter is based somewhere about the use of a rate so much per room per month with kw.h. addition to it. I think it would repay any company, more particularly a company having to deal with a number of small towns, to make an actual survey of some town, obtaining diversity factor, and also finding out the demands on houses with regard to their area or their cubical contents. Try and find out in pure abstract theory what is your right rate; then go ahead and bring in your commercial men and sugar-coat the pill so that the average consumer can understand it and can carry it out. The rate as used in Ontario by the Hydro-Electric Power Comimssion was not the original rate designed. The original rate designed was based on a room rate, and I understand that it was designed by Mr. Alexander Dow, of Detroit.

The President: This is a very important phase of rate making that Mr. Maclachlan has brought up. He omitted to explain that in the theory of rates there are at least two divisions; one to cover a fixed charge, cost of service, and the other to pay for the current supplied. Now, I understand that this area room charge, etc., is designed to pay companies a return to take care of the fixed charge of service, and the kw.hour is a separate item added to that. The Hydro-Electric adopted a floor space plan, which is a scientific rate. The people objected to floor space plan as it became a minimum throughout the year and when they shut their houses up for the summer they found that they were paying minimum anyway. In order to offset that objection our company adopted a room rate, so that for the first four kw. hours at the first step and second four at the second step and balance for merely the current. This has worked out very well. We took 10,000 cases of residences and worked them up and found out that the average use of residence at

that time, about two and a half years ago, was seven kw. hours per room per month. So that the first two steps of our rates, embracing as it does 8 kw. hours per room per month, amply covers any loss through empty houses in the summer. We have no minimum charge, and it appeals to the householder, and they prefer it, I think, to the floor space minimum.

Mr. Randall: I would like to ask Mr. McDougall what the consumption is per room per month if he has any data on it.

Mr. Gilman: I can answer that question to a slight extent by stating that the load factor of our residence business has certainly increased. We are not just sure at present as to whether or not our residence customers' consumption quite reaches the figure of 10 kw. hours per room per month, as the winter and summer average. I know it has increased very considerably and I think it only reasonable to assume from figures in my possession that it will closely approximate the above mentioned figures. Certain of our member companies having comparatively high lighting rates, will undoubtedly find that their kw. hour consumption per room per month may be as low even as 3. Our experience has proved that a decrease in rate has the immediate effect of increasing the load factor. In Toronto at present our output is about five times the output previous to our reduction in 1911. Of course, there is a great deal of the increase due to normal growth, but we credit by far the greater part to the rate reduction which has taken place.

Mr. Randall: That was the point I am trying to bring out, that reducing the rate will largely increase consumption per month, and there must be some point that would be the very best point to get the best results.

The President: Mr. Davies, anything you would like to add?

Mr. Davies: Well, Mr. Chairman, we can give Mr. McDougall and Mr. Gilman a little information regarding connected load basis. I went through the same thing some time ago, and I took all our power customers at that time, found that the average test was 60 per cent. of the connected load. I, myself, found the small customers a nuisance. Take a test on them at a time when they are busy, they object to paying for that amount at a later date when they get slack, and although the contract may state they have to, it causes a continual succession of applicants to the door of reductions. In view of this our company has cut out tested rates where possible up to about 25 h.p. Above that point I am rather chary of cutting them out, because a man that uses from 25 to 50 h.p. knows a great deal about the electrical business and is quite liable to get a motor and overload it. So that your 60 per cent. proportion may not hold. What we did was, we found that the average test was 60 per cent. of connected load, so we took our normal tested rate and multiplied it by 70 per cent., giv-

ing ourselves 17 per cent. leeway, and in that way come out alright. We do not take any tested rates, unless a customer absolutely insists upon it, on anything smaller than 25 h.p.

There is one good thing to have in any of these connected load contracts, which I think is equitable, and that is that we shall have the right to take the tested load if the test exceeds the rate of capacity of the motor. Without doubt it is the easiest thing in the world to sign a man up under these conditions. A man comes in and says: "I have a 5 h.p. motor, how much will it cost?" I don't have to ask how much load he is going to put on, how many machines, and estimate that it will cost him so and so. You can come out flatfooted and tell him that it will cost him $175 a year, or $15 a month. And the customer signs it, is quite happy and does not expect a reduction when he gets slack.

Mr. Randall made one statement there that I would like to qualify, and that is, in speaking of the reduction or the increase in net earnings of companies whose rates have been reduced by public service committees, he stated: that this was contrary to the desire of the Public Service Commissions. I do not think that applies in America. Our record and the record of the N.E.L.A. Rate Committee is that the different Public Service Commissions in the States are fair. They look after the companies just about as well as they look after the consumer. And unless some very different trend of opinion comes into these Commissions, I don't think it would be wise to go on record as stating that they had any desire at any time to reduce the net earnings. Mr. Randall might like to qualify that.

Mr. Randall: What I meant to say was this: Say they approved of 8 per cent. return, or whatever return was approved of, the actual return at that time was greater. Their intention was to get it down to their approved return.

Mr. Davies: Regarding room rates, we had one experience of double rate for lighting. We gave a rate in Montreal of first 30 kw.h. per month per connected kw. a certain rate and balance lower rate. We never got out of the trouble with it. We backed down to straight kw.h. rate, which we have now, and we find it more satisfactory.

The President: You cannot change the number of rooms in a house.

Mr. Davies: No, but people in Montreal may not be quite as intelligent as those in Ontario. At any rate they did not seem to be at all keen on any rate that is not immediately discernible.

The increase that Mr. Gilman speaks of between 1915-1917 would easily be accounted for by the additional use of appliances. Without doubt the increase in appliances is bound to make a difference of kw.h. per room, and same is probably not altogether due to increased amount of lighting.

Mr. Gilman: Right in this connection, my contention was that the decreased rate encouraged the use of appliances, and for that reason was accountable for the increased load factor.

With relation to the determination of maximum demand on the percentage basis I would like to qualify here what I said before, and advise that I omitted to then state that we are planning on leaving it optional with ourselves as to whether or not the maximum demand will be taken on a percentage basis or by measurement. We have found by experience that a good many of our customers, particularly during the present time, will greatly overload their motor equipment due to their inability to promptly receive new motors. We had a good instance of that the other day, in a customer with a 50 h.p. motor carrying a continuous load of 90 h.p.

Mr. Davies: There is always a danger in that. I am glad to find that our rate comes within the points chosen or discovered by Mr. Randall. He discovered it came within 4¾ and 6. As you know, our rate in Montreal is 5c.

Mr. Randall: There was one point brought up yesterday, and that is, that when new things were tried it would be much better if the companies would not expect results for several months. I think it is true that when any change is tried with respect to the public no decision should be made on that change inside of a year, because it takes about that time for public opinion to crystallize and for the people to really know what they want to do.

The President: I quite agree with you. We had several experiences along that line in Toronto. The first intimation of change, the first two or three months meant a certain amount of explanation to the customers. The last thing we did, we withdrew our free lamp renewals. Our competitor does not give those to the customer. We used to give residential customers free lamps. I think in the year 1916 those free lamps, including the handling and testing of them, cost us pretty nearly $40,000. Now, we have saved that and practically increased our rates through the withdrawal of them, although we conceded something in our rate on the second step to the customer, and there has been very little opposition. We hear nothing of it now. That was started the first of this year. It takes a little while—you must not allow the disturbance occurring at the beginning of introduction of a change to influence your judgment until the thing has had a fair trial.

If there is no further discussion on this paper—I do not want to stop it; it is very educational, and I would like to give everybody an opportunity—if there is any further discussion we would like to have it.

Mr. Dion: I wish to move a very hearty vote of thanks to the Public Utility Corporations of Montreal and the local section of the

N. E. L. A. for the attention they have given us while we have been here and the very splendid entertainment we have received at their hands. I am sure this resolution will be carried unanimously. ——Resolution carried by standing up and hearty hand-clapping.

The President: If there is no further discussion I will declare this meeting adjourned, and there will now be a Class A meeting of the Class A members, for the business of the Association confined exclusively to Class A members.

Proceedings of

Annual Convention

29th Year

of the

Canadian Electrical Association

Held at Alexandra Bay, N.Y.

June 27-28, 1919

Office of the Association
12 Adelaide St. East
Toronto, Ontario

Canadian Electrical Association

Officers—1919-1920

PRESIDENT:
A. Monro Grier, K.C.,
Canadian Niagara Power Co., Niagara Falls, Ont.

FIRST VICE-PRESIDENT:
E. A. Dunlop, M.P.P.,
Pembroke Electric Light Co., Pembroke, Ont.

SECOND VICE-PRESIDENT:
P. T. Davies,
Southern Canada Power Co., Montreal, Que.

THIRD VICE-PRESIDENT:
A. P. Doddridge,
Quebec Railway, Light, Heat & Power Co., Quebec City, Que.

HONORARY SECRETARY:
T. S. Young,
347 Adelaide Street West, Toronto, Ontario

SECRETARY-TREASURER:
Wm. Volkmann,
Toronto Power Co., 12 Adelaide St. E., Toronto, Ont.

ADVISORY COMMITTEE:
Composed of Past Presidents Eligible for Office.

MANAGING COMMITTEE

C. S. BAGG,
Montreal Light, Heat & Power Consol., Montreal, Que.

R. J. BEAUMONT,
Shawinigan Water & Power Co., Montreal, Que.

A. A. DION,
Ottawa Electric Co., Ottawa, Ont.

J. S. GOULD,
Rideau Power Co., Merrickville, Ont.

F. T. KAELIN,
Shawinigan Water & Power Co., Montreal, Que.

H. R. MALLISON,
Nova Scotia Tramways & Power Co., Halifax, N.S.

D. H. McDOUGALL,
Toronto Power Co., Toronto, Ont.

R. B. McDUNNOUGH,
Public Service Corporation, Quebec, Que.

W. H. McINTYRE,
Ottawa Electric Co., Ottawa, Ont.

J. F. NEILD,
Toronto Electric Light Co., Toronto, Ont.

J. S. NORRIS,
Montreal Light, Heat & Power Consol., Montreal, Que.

L. W. PRATT,
Hamilton Cataract Power, Light & Traction Co., Hamilton, Ont.

J. B. WOODYATT,
Southern Canada Power Co., Montreal, Que.

THE PRESIDENT,
National Electric Light Association, New York.

CONTENTS

PROCEEDINGS.

At a meeting of the Managing Committee held at Montreal in February, the following places were suggested for our Twenty-Ninth Annual Convention, namely: Niagara Falls, Hamilton, Alexandria Bay, N.Y., and Montreal. In accordance with the view of the majority of the members of the Executive, the Convention was held at Alexandria Bay, N.Y., on June 27th and 28th.

The meeting was not as well attended by individual members as some of our previous conventions held in the larger centres. The attendance, however, was very representative of our Company members and manufacturers.

The members present were very enthusiastic, and the papers presented by the various Committees were well received. Some of the Committees suggested certain new lines of action for the Association, which it is proposed to take up during the coming year. There were also two special papers presented, involving new developments in the field of the industry.

An informal dinner was held on the evening of June 27th, which was attended by all the members present at the Convention. Mr. Warburton, Proprietor of "The Thousand Island House," provided a very excellent dinner, after which a few remarks were made by Mr. S. A. Sewall, Mr. W. J. Onken, Dr. Carr, Mr. P. T. Davies, and our President, Mr. A. Monro Grier, K.C., whose remarks in the main were a tribute to those who by their splendid efforts had made possible the conclusion of the war of the past four years by the signing of the Treaty of Peace.

The President, Mr. A. Monro Grier, took the chair at 10.30 a.m.

The President: Ladies and Gentlemen—I am very glad that I can begin in that way this morning. I notice that the first order of business on our programme is something solemnly entitled as follows: Address of the President, etc., and the next item is appointment of Committee on President's Address. You will be interested to hear that item number two can be absolutely disregarded by reason of the fact that item number one will be practically non-existent.

THE PRESIDENT'S ADDRESS.

There are one or two things which I am going to speak about, not in any measured or formal way, certainly with no effort at precision. I just want to indicate some of the activities of the Association. Before I do that, however, I should like to say something which lies very close to my heart, and that is, that I feel that each of us welcomes each and all the others of us. We are meeting at a place com-

REPORT OF SECRETARY-TREASURER, 1918-1919.

To the President and Members of the Association:—

Since my election to this office at our last Annual Convention, it has been my constant endeavor to improve and re-establish the activities of the Association, to the end that we might be truly representative of the private Electrical Public Utility Companies of Canada, and those interested in these companies.

You will probably realize that there have been no calls made on our Member Companies for special subscriptions during the past year, and although this has not been done, the finances of the Association are in better shape than they have been for some years. In order to avail ourselves of the privilege extended by Canada to help finance the war through the Victory Loan, your Secretary-Treasurer, with the approval of the Managing Committee, invested seven hundred dollars ($700.00) of the Association's funds in fully registered bonds, the interest of thirty-eight dollars and fifty cents ($38.50) per year helping to finance our work.

Our Auditors' statement shows our assets to be $2,532.15. There is outstanding against this about $80.00 in invoices due July first.

We have enrolled the following new members during the year:—

Class A	1	member.
B	37	members.
C	0	"
D	2	"
E	2	"
Total	42	"

The largest number of Class "B" members were those enrolled in the local Toronto Section.

We have sent out a number of circular letters and questionnaires during the past year to all our Class "A" member Companies, but I am sorry to say that as a rule we receive very few answers; this would seem to indicate that our efforts along different lines were not meeting with the support of our various members.

At this time I would like to urge all our members to use their good influence to renew and rebuild the activities and membership of

the Association. To do this we need the very active co-operation of all of our Member Companies, as well as the good work of the individual members.

This is the re-construction period, and I think it is up to every member to apply this to the Association as well as to other lines.

In closing I wish to thank our members for their co-operation during the past year.

Respectfully submitted,

WM. VOLKMANN,
Secretary-Treasurer.

The President: I may say that the Secretary-Treasurer has some letters which he thinks would be of interest to the Association, and I think perhaps it would be proper to have them now.

Secretary Volkmann: We have issued invitations to various men to attend our Convention, among them Mr. T. C. Martin, Secretary of the N.E.L.A., and Mr. Martin J. Insull, of the Commonwealth Edison, Chicago. I have a letter from Mr. Insull's secretary, which I do not think it necessary to read, but sufficient to state that Mr. Insull was out of the city and was not returning to Chicago until a day or so before this Convention, so that it would make it practically impossible for him to be here.

The letter from Mr. Martin is in response to Mr. Grier's invitation.

The President: I think as this is an individual letter to myself I will read this one as from Mr. Martin to myself.

Twinbrook Farm, Ringville, Mass., June 20, '19.

Hon. A. Monro Grier, K.C.,
Toronto, Can.

Dear Mr. Grier:

I am just in receipt at my farm herein in Western Mass., of your kind invitation of June 14, to attend the annual meeting of the C.E.A., at Alexandria Bay, June 27-28; and would certainly be most happy to accept. I have many pleasant recollections of past Canadian Conventions, including the last, when you were elected as President.

I am, however, officially on sick leave, and was terribly tired out when I came here some weeks ago; although at this moment I never felt better in my life. Should none of my elective associates be able to attend, I shall be very glad to be instructed to represent the N.E.L.A., as in bygone years. I am therefore sending a copy of this letter to the New York Office and shall await orders. Meantime,

with thanks for your thought of me, and heartiest wishes for a successful and memorable meeting, believe me,

Yours most sincerely,
(Signed) T. C. MARTIN.

I read this because I wish to say that presently I shall be able to welcome a representative from the N.E.L.A., and our only regret is that we have not, in addition to the one we have here, our old friend Mr. Martin, from whom we have received that appreciative letter.

Secretary Volkmann: We have received a number of communications, one from the Ontario Association of Electrical Contractors and Dealers, by Mr. K. A. McIntyre, Chairman, asking us to appoint a representative to co-operate with other organizations in Ontario with a view to establishing better co-operation in the electrical industry.

We have received two different communications from the Canadian Engineering Standards Association. The Canadian Engineering Standards Association, a body recognized by the Government, can appoint sub-committees composed of representatives of the various companies, manufacturers, users, etc., who are interested in the adoption of standards covering various standard products, to consider and propose standard specifications; their intention being to get all those who are interested in one particular line together with a view of adopting standards of manufacture so as to eliminate a large amount of special equipment, with a view to promoting greater efficiency. I have a letter from Mr. Durley, Secretary, asking us to appoint a representative to act on a sub-committee taking up the standardization of transformers.

We have a similar letter in connection with the standardization of electric lamps. I do not think it necessary for me to read the letter except to say that they ask a representative from the Canadian Electrical Association.

I might say in connection with the Transformer Sub-Committee that our Electrical Apparatus Committee this year in making up their report made it up along the lines of having a discussion on this question, so that the Canadian Electrical Association might work along the lines of the report of the N.E.L.A. on the standardization of transformers. This report will probably be right in line with the work that the Canadian Engineering Standards Association wishes to take up.

I think that is all the correspondence I have to take up.

The President: The next item of business is an address by representatives of the National Electric Light Association, and in that connection I have the pleasure of stating that we are very glad to have with us this morning Mr. Sewall, the Acting Secretary of the National Electric Light Association, and we share to a certain extent

the happiness of Mr. Sewall himself in that he has the pleasure of having Mrs. Sewall with him also. We welcome Mr. Sewall to our midst this morning, as well as Mrs. Sewall, and we ask from Mr. Sewall some few remarks to cover this item on the programme.

ADDRESS BY MR. S. A. SEWALL.

Mr. Sewall: (was received with hearty applause.) Mr. Chairman, Ladies and Gentleman:—It gives me sincere pleasure to bring the greetings of the President and Executive Committee of the N.E.L.A., together with the good will and wishes of every one of our 12,000 individual members. There has always been a wonderfully good feeling of fellowship between the Canadian Electrical Association and the N.E.L.A. This is not a fellowship for gain or profit so much as the heartfelt feeling that we on one side of the line have for you on the other.

A year ago you were working hard to keep pace with the ever changing work brought about by the war, and now that peace is here, the problems before you to-day are even more complex than those arising out of the war, and they must be solved. Far from being able to rest on your laurels, you must put your shoulder to the wheel and push without rest and without pause. These problems must be solved, not to your satisfaction, but to the satisfaction of all, for the industry that we serve brings to the people more real service, more pleasure and more comfort than any other. And while you are thinking of this service, why not look to an ideal, keep it before you —an ideal that is almost visionary—when there will be no inhumanity of man to man and the countless thousands will cease to mourn and there will be a glorious peace on earth and goodwill towards all men. I thank you. (Loud applause.)

The President: I should like to pause for a moment in our proceedings now to record, upon behalf of all of us, and most distinctly including myself, our very great appreciation of the utterance we have just listened to from Mr. Sewall. How well timed it was was evident in listening to it. The only quarrel we could have with it was upon the score of brevity; but, after all, there is this to be remembered with reference to short and terse remarks, that we are far better able to remember the whole of them than if they were longer. And when remarks are characterized by such fine significance and clear pointing to the things which are of worth and value, I feel that as has been the case with the happy remarks to which we have just listened to we are all pleased to think that we shall remember them with ease as well as with joy. (Applause.)

I now have the pleasure of announcing to you that there will be a dinner of the Association this evening.

The next on the programme is the Report of the Committee on Accident Prevention, by Wills Maclachlan.

REPORT OF ACCIDENT PREVENTION COMMITTEE.

Wills Maclachlan, Chairman.

Mr. President and Members of the Canadian Electrical Association:—

Your Committee on Accident Prevention has held three meetings during the year just closing. We have had before us the work done by the Accident Prevention Committees of the National Electric Light Association, and have tried as far as we were able to adopt the report and proceedings of that committee to Canadian conditions.

During the war, although companies well realized the great need for the conservation of human life, due to the depletion of men for service overseas, yet they felt in some instances, where it could not be perfectly proven that certain arrangements would materially assist in the saving of life, that the money and labor were not available for the carrying out of these otherwise laudable schemes. With the signing of the armistice, and, as we hope, the signing of peace within a few days, conditions have materially changed, and this Association might well look forward to carrying into very active operation some of the schemes that have been found to have merit in the prevention of the loss of life or limb to the employees of the electric companies. Some of the more important points that have been taken up by your committee might be classified under the following sub-titles:

Insulated Handles.

Your committee wishes to draw to the attention of the Association the extreme hazard in allowing men to use tools with insulated handles that are purchased from various manufacturers. This insulation is oftentimes depended upon for the protection of life, where it is more a case of good luck than good management that a fatality does not result. Your committee would recommend to the Association that, so far as possible, tools with insulated handles be not used except for very high voltages, where special tools are required, but that dependence be placed upon rubber gloves tested according to specifications that will appear hereafter.

Classification of Reports of Accidents.

For the past few years the National Electric Light Association has requested their members to report accidents on a form (Page 18) prepared by the Association to headquarters. These reports are then compiled and statistical information prepared therefrom. This information is of inestimable value to member companies in seeing where most of the accident loss has occurred in the past, and so be prepared for the preventing of similar loss in the future. Your committee would recommend that similar forms be prepared by the Canadian Electrical Association, and company members be requested to report accidents to the Canadian headquarters, the statistical information from which could be prepared and submitted to your

Association. At the same time the information being prepared in a similar way to that used by the N.E.L.A. would be conveyed to the N.E.L.A. to assist them in presenting more complete data.

Rubber Glove Specification.

For some years past the committee of the N.E.L.A. has been working on the question of the preparation of a specification for "the purchase, testing and care of rubber gloves for service on high voltage apparatus on circuits not exceeding 3,000 volts to ground." Your committee has collaborated with the N.E.L.A. committee and submits herewith, marked "Appendix 1," page 19, such a specification. Your committee would recommend that these specifications be adopted by this Association and used by the Canadian member companies.

Specifications for Linemen's Belts.

Similarly with the case of linemen's belts, we have collaborated with the N.E.L.A. committee, and a tentative specification has been prepared, copy of which is attached, together with blue print, and marked "Appendix 2," page 24. Your committee would recommend that these specifications be used by member companies as a tentative specification and criticisms and reports of attached be reported to your committee so that more information can be obtained before a definite specification is adopted.

Co-operation for Safety Work.

Your committee has had brought to its attention by one of its members, the very successful work of the Hamilton Electric Safety First Association, composed of the Hamilton Hydro-Electric, Dominion Power & Transmission Co., Bell Telephone Company, C.P.R. and G.N.W. Telegraph Companies, Hamilton Fire and Police Departments. By this Association dangerous points on the various overhead lines in the City of Hamilton were brought to the attention of the officers of the proper companies, and where possible the difficulty was rectified. We attach hereto, marked "Appendix 3," page 27, a report by a member of this committee, together with other data, and would recommend to the Association, where possible, the adoption of this scheme in other cities.

The bulletin of the N.E.L.A. has a section devoted to the work of accident prevention, and your committee would direct the attention of the member companies to this section of the bulletin. Data is presented there, and short articles pertaining to accident prevention in the utility field, and it is hoped that such information will be read and put into practice where possible by your companies. This is practical information, written by those in utility work, for the information and guidance of men like situated.

Pensions and Sick Benefits.

The National Electric Light Association at their Atlantic City convention saw fit to instruct their officers to appoint a committee to

look into those most important employee relations pertaining to pensions, sick benefits and other welfare and economic lines for the benefit of the employees of the electric companies. In these times when the newspapers and other press are full of problems of unrest, particularly that applied to relations between the employer and employed, it is not necessary for this committee to point out to you the seriousness of the situation, but we would respectfully recommend that the Canadian Electrical Association take ample means whereby their member companies, and particularly the executives of their member companies, are kept fully advised as to the best methods for solving this most serious problem, and where your committee can most help it will be glad to do so if directed.

Educational and Publicity Methods.

In the report of the Accident Prevention Committee to the N.E.L.A., they made a very full and complete report in connection with educational and publicity methods in connection with accident prevention. Your committee would direct the attention of the member companies to this report. It is very complete and well warrants the reading; particularly of executives of companies.

Goggles.

It has been found that some member companies do not know where to find the goggles that they require for the protection of their men. For general information, goggles for the protection of the eyes of workmen from electric flash can be obtained from A. H. Hardy & Co., 10 South Wabash Avenue, Chicago, Illinois. They are called the "Harco Safety Goggle," and if fitted with Noviol lens will protect the eyes of workmen from the ultra-violet in an electric flash. Your committee would also recommend that member companies see that their men are equipped with suitable goggles for the protection of the eyes from flying chips of steel or concrete when doing any chipping or drilling of these materials. These goggles can be obtained from a number of reliable goggle manufacturers, and if member companies are not able to obtain the suitable goggles, information will be supplied from your Association headquarters.

Resuscitation from Electrical Shock.

Your committee has been giving particular attention to the question of resuscitation methods for electrical shock, and has kept in touch with the work being carried on in the United States. Without further comment, we would recommend that this Association formally approve "the rules for resuscitation from electrical shock by the prone pressure method," as issued by the N.E.L.A., in booklet and chart form, copy of which rules are attached and marked "Appendix 4," page 29. We would further recommend that this Association make arrangements to print the rules and the accompanying chart over the

name of the Canadian Electrical Association for distribution where found desirable in Canada. For your information, these rules have already been approved by the Hydro-Electric Power Commission of Ontario, and by the Association of Municipal Electric Utilities of Ontario.

Your committee feels that it has done very little during the year, but has attempted to present before you some of the more important points in connection with the work of accident prevention. These points may appear to deal more with the physical side of the work, but in previous reports your attention has been drawn to the fact that without sincere co-operation and active participation in the work of accident prevention, from the highest official of the company down to the newest employee, successful accident prevention is impossible.

Respectfully submitted,

R. F. HAYWARD.	F. T. KAELIN.
L. A. KENYON.	J. H. MARTIN.
W. H. McINTYRE.	J. F. NEILD.
F. E. O'NEIL.	J. S. H. WURTELE.

WILLS MACLACHLAN, Chairman.

Mr. Maclachlan: I would like to move the formal adoption of the report.

The President: Gentlemen, it is always a pleasure to hear Mr. Maclachlan on the subject of Accident Prevention, because he is really one who knows the subject, and I feel quite sure that the proper action will be taken with reference to his suggestion as to the adoption of the rules which he mentions. Mr. Maclachlan has moved that his report be adopted. That should be seconded by someone.

Mr. Dion: I am pleased to second that, and in doing so I would like to emphasize what has been said and express the hope that the report will be by no means pigeonholed but that the incoming Executive will act on the recommendations contained in the report.

The President: Before I put the motion is there any discussion on the paper?

Mr. Maclachlan: Might I distribute some of the Resuscitation booklets that we have?

The President: Do you prefer to do it now or afterwards?

Mr. Maclachlan: They might come into the discussion of this report.

Secretary Volkmann: I might state there are sufficient of these Resuscitation booklets here, so that if any of you wish to take them along for reference—there are plenty to go around.

The President: If you are content to adopt the report as made without discussion, I will put it to the meeting. It has been moved and seconded that the Report of this Committee be adopted; is it your pleasure? (Carried.)

NATIONAL ELECTRIC LIGHT ASSOCIATION.

Committee on Accident Prevention

REPORT OF ACCIDENT TO EMPLOYEE

For the confidential use of the Committee to assist in a study of accident prevention.

EMPLOYER: Name and Location

AGE OF INJURED EMPLOYEE (Name not required) Occupation

ACCIDENT: Day and Hour

Brief Description

INJURY: Part of person injured

Extent and probable time lost on account of injury

SUGGESTED REMEDY (to avoid such accident)

Where possible attach photograph or drawing to illustrate accident. Use back of this report for such additional information as may be given.

191 Signed

This Report should be sent to the Statistical Secretary, National Electric Light Association, 29 West 39th St., New York City.

Appendix 1.

SPECIFICATIONS FOR THE PURCHASE, TESTING AND CARE OF RUBBER GLOVES FOR SERVICE ON HIGH VOLTAGE APPARATUS ON CIRCUITS NOT EXCEEDING 3,000 VOLTS TO GROUND.

A. PURCHASE SPECIFICATIONS:

Note: These specifications refer only to the rubber glove itself, and are not intended to cover either an external or an internal non-rubber glove with which the rubber glove may be intended to be used. As a further factor of safety, rubber gloves should be used with suitable protective covering.

1. General Description.

The gloves furnished under these specifications shall be manufactured by the "dipping" process, and shall be free from seams or patches of any kind. The material shall be a high grade rubber or rubber compound, properly vulcanized and shall comply with the specifications described in the following paragraphs. The gloves shall be reversible and both surfaces shall be smooth and free from blisters, pin holes, protuberances, cracks and any particles of foreign matter or any other physical defect which can be detected by a careful and thorough facial examination.

Note: (a) Experience indicates that gloves vulcanized by the acid method deteriorate more rapidly.

2. Marking.

Each glove shall be marked in such a way as not to injure the glove, with the name of the manufacturer, the size of the glove and a serial number.

3. Length and Size.

Unless otherwise specified, the length of each glove shall not be less than 14 inches as measured from the tip of the second finger to the edge of the cuff. The size of the glove shall not be less than the size marked on the glove, the measurement to be made around the hand at the knuckles in the usual manner.

4. Thickness.

The average thickness of gloves which are to be used with outer protective non-rubber gloves, shall not be less than 50 mills. The thickness at any part of any glove shall not differ from the average thickness by more than 15 % of the average thickness.

5. Inspection and Voltage Test.

Each glove submitted shall be carefully inspected for the defects outlined in paragraph 1, both inside and outside (by reversing). Each

glove which is acceptable shall then be subjected to an alternating potential of 10,000 volts (r.m.s. value) for not less than three minutes without puncturing or without showing a leakage current of more than 10 milli-amperes at any time during the test.

6. Physical Properties.

A test specimen cut from a glove shall have the following physical properties:

Tensile strength—not less than 1,200-lb. per sq. inch. Total elongation at rupture—not less than 500 per cent. in two inches (2 inches stretched to 12 inches). Elasticity—set of not more than 0.4 inch in 2 inches.

7. Dielectric Strength.

The gloves shall be capable of withstanding the application of 18,000 volts (r.m.s. value) for one minute without puncturing or without showing a leakage current in excess of 15 milli-amperes per glove.

8. Test Methods.

All tests shall be made in accordance with the procedure prescribed in "Specifications for Methods of Testing Rubber Gloves."

9. Acceptance and Rejection.

Those gloves complying with all requirements of these specifications shall be accepted. If, however, gloves which pass clause No. 7, fail in the test in clause No. 5, the entire lot shall be rejected.

B. SPECIFICATIONS FOR METHOD OF TESTING RUBBER GLOVES.

1. Voltage and Leakage Current Test.

The gloves should be tested in ordinary hydrant water at normal room temperature (60 to 80° F.) by immersing in the water to within about 1½ to 2 inches of the edges of the cuff and filling with water up to the same point. The water inside the glove and that outside the glove forms the test electrodes. These are conveniently connected to the testing transformer by means of a chain suspended in the glove and by direct connection to the containing vessel.

The testing voltage should be obtained from a testing equipment, no part of which has a rating at the testing voltage of less than ½ kv-a per glove being tested. In no case should the rating of any part of the testing apparatus be less than 2 kv-a. The frequency of the testing voltage should not be over 65 cycles.

The potential should be applied at a low value and gradually and steadily raised and lowered at a rate of approximately 800 to 1,000 volts per second, until the prescribed testing voltage is reached. The test period should be counted from the instant when the prescribed testing voltage is reached.

The method of regulating the testing voltage should be one which does not distort the wave form of the testing voltage from a sine wave. Acceptable methods include:

(a) Field regulation of the alternator supplying the transformer.

(b) Induction-type regulator.

(c) Variable-ratio-transformer type of regulator.

(d) Potentiometer type of rheostatic control where the current in the portion of the "potentiometer" resistance in parallel with primary of the transformer is at least five times the exciting current of the transformer.

The testing voltage may be measured by:

(a) A properly calibrated electrostatic voltmeter connected directly across the gloves under test, or,

(b) Any properly calibrated commercial type of alternating voltmeter connected to the low tension side of the transformer in conjunction with the ratio of transformation of the transformer provided that the ratio is definitely known for all test conditions, or,

(c) A calibrated potential transformer with a voltmeter.

The leakage current may be measured by:

(a) Directly by inserting a milliameter in series with each individual glove in turn, or,

Note: It is customary to make high voltage tests of this character with one end of the circuit grounded, the containing vessel usually being the grounded end of the circuit. The milliameter should, therefore, be connected in at the grounded end of the circuit and shunted by a short circuiting automatic self-closing switch, which will therefore always keep the circuit closed except at the instant of reading and thus maintaining an uninterrupted ground.

(b) An ammeter in the low tension circuit of the testing transformer. In this case the leakage current should be determined by noting the decrease in the low tension current when the glove is disconnected from the high tension testing circuit, the voltage being left on the test circuit.

The difference in the two currents divided by the ratio will give the leakage current with sufficient accuracy. If several gloves are tested at one time, the leakage current may be determined by noting the decrease in the low tension current, when one glove at a time is disconnected from the test circuits, the remaining gloves being left connected to the circuit.

Each glove which passes this voltage and leakage current test should be stamped with the date of test.

2. Dielectric Strength Test.

Two per cent. (2) of the gloves which pass the acceptance test (Clause 5 in "Purchase Specifications") should be selected at random and tested for dielectric strength. The gloves should be filled with water and immersed in water in the manner prescribed in Clause 1, above. The potential should be applied at a low value and raised

steadily and gradually at a rate of approximately 800 to 1,000 volts per second until 18,000 volts (r.m.s. value) is reached, which potential shall be held for one minute.

3. Thickness.

The gloves which are punctured in the dielectric strength test should be measured for thickness by slitting the gloves and making measurements at 12 different places as follows: At two different points on the palm of the glove not less than 1.5 inches apart, at the crotch between the thumb and first finger, on the inside of each finger and thumb, at two places on the back of the hand opposite the palm not less than 1.5 inches apart and two places on the cuff of the glove not over three inches from the edge and not less than four inches apart. The average of these 12 measurements is to be taken as the average thickness.

The measurement may be made with any micrometer graduated to tenth mills, having a ratchet friction attachment. The tension in the friction attachment should be so adjusted that when the anvil has come to a stop on the specimen, the specimen can be moved between the spindle and anvil without causing any appreciable stretching of the rubber.

4. Physical Tests.

Two test specimens having a length of not less than 6 inches should be cut from each glove which has been subjected to the test for dielectric strength and which has been measured for thickness. These specimens should be marked at the middle with two bench marks two inches apart. The specimens should have a uniform cross section at least in that portion including the bench marks and they should be as free as possible from surface incisions, imperfections and irregularities which would obviously give abnormal result. The area of the specimen should be determined by micrometer measurements of the dimensions throughout the uniform section of the specimen.

The tensile strength, elongation and set tests should all be made on one specimen by inserting in the grips of the testing machine and proceeding as follows:

(a) **Set Test.**—The grips of the testing machine shall be separated at the rate of 20 inches per minute until the bench marks are 12 inches apart. Within five seconds after reaching the prescribed distance, the specimens shall be released and the distance between bench marks measured at the end of one minute. The difference between this distance and two inches will be the set of the specimen.

(b) **Elongation and Tensile Strength Tests.**—The specimen will then be again placed in the grips of the testing machine and the grips separated at a rate of 20 inches per minute until the specimen breaks. The total load and the distance between the bench marks at rupture is to be observed. The tensile strength should be computed on the

basis of the original area of the cross section. If a specimen breaks within ½ inch of either grip of the testing machine as it was originally placed in the machine, the test should be rejected and another specimen tested.

C. METHOD FOR THE USE AND CARE OF RUBBER GLOVES IN SERVICE.

1. Periodic Inspection and Test.

Each glove shall be subjected to a monthly inspection and high voltage test.

At the end of this period all gloves shall be turned into the laboratory for test and subjected to the following treatment:

(a) Each glove shall be thoroughly cleaned, using soap and water to remove oil or grease.

(b) Each glove shall then be carefully inspected both inside and outside in accordance with Clause 1 of the "Purchase Specifications."

(c) Each glove shall be tested at a voltage of not less than 2½ times the maximum voltage on which the glove is to be used for three minutes. Each glove that punctures or shows leakage current in excess of 10 milliamperes shall be destroyed by slitting with a knife from one end to the other or so marked by punching holes on the wrist band as to insure their use for non-electrical purposes only.

2. Storage.

It is recommended that gloves which are not in service be kept in a reasonably dry and cool place where the temperature never exceeds 75 degrees Fahrenheit. The gloves should not be exposed to the light and each pair should preferably be kept in a separate box.

3. Use.

All employees whose duties require the use of rubber gloves shall frequently and carefully inspect the gloves used and immediately turn in any which have apparent defects of any nature. Gloves about which there is any doubt shall be turned in to the Company for proper tests.

Special compartments should be provided in crew wagons, tool chests and other places for the disposal of gloves when not in actual use by the men. Their compartments should be so arranged that there can be nothing but the gloves in them, and the gloves should be thoroughly protected from mechanical injury by tools in the wagon or chest.

4. Records.

A serial number shall be assigned to each glove purchased and a record of its history kept. This record shall show the date received at the storeroom, the date of each issuance, the department to whom it was issued and the date of each periodic inspection and test. If the glove is injured or develops a defect in service, a record of the facts shall be made when the glove is turned in.

Appendix 2.

SPECIFICATIONS FOR THE PURCHASE OF LINEMEN'S BELTS.

Compiled by the Sub-Committee on Accident Prevention, N.E.L.A.

General.

1. The materials used in the manufacture of these belts shall be of the best obtainable of the grades specified, and the workmanship shall be of the best.

2. The drawings on page 25 form a part of, and supplement these specifications.

Definitions.

3. A lineman's belt shall consist of two members, (a) Body Belt, and (b) Safety Belt.

4. The body belt shall consist of the following parts: (a) Cushion, (b) Strap, (c) Tool Strap, (d) Strap-keeper, (e) Protecting Pads, (f) Buckle, (g) "D" Rings, (h) Rivets.

5. The safety belt shall consist of the following parts: (a) Strap, (b) Leather or Metal Reinforcements, (c) Snaps, (d) Buckle, (e) Rivets.

6. The general arrangement of these parts shall be as shown in the drawings on page 25.

7. The length of the body belt shall be taken as from the extreme end of the buckle to the middle hole at the other end of the belt.

Inspections.

8. At the option of the purchaser, an inspector shall be permitted to be present during the manufacture of the belts, and shall be given every opportunity to assure himself that the belts are made in accordance with these specifications.

9. Acceptance by the inspector of any material or method of manufacture shall not, however, relieve the manufacturer from the obligations of these specifications.

Tests.

10. All belts shall comply with the following test:

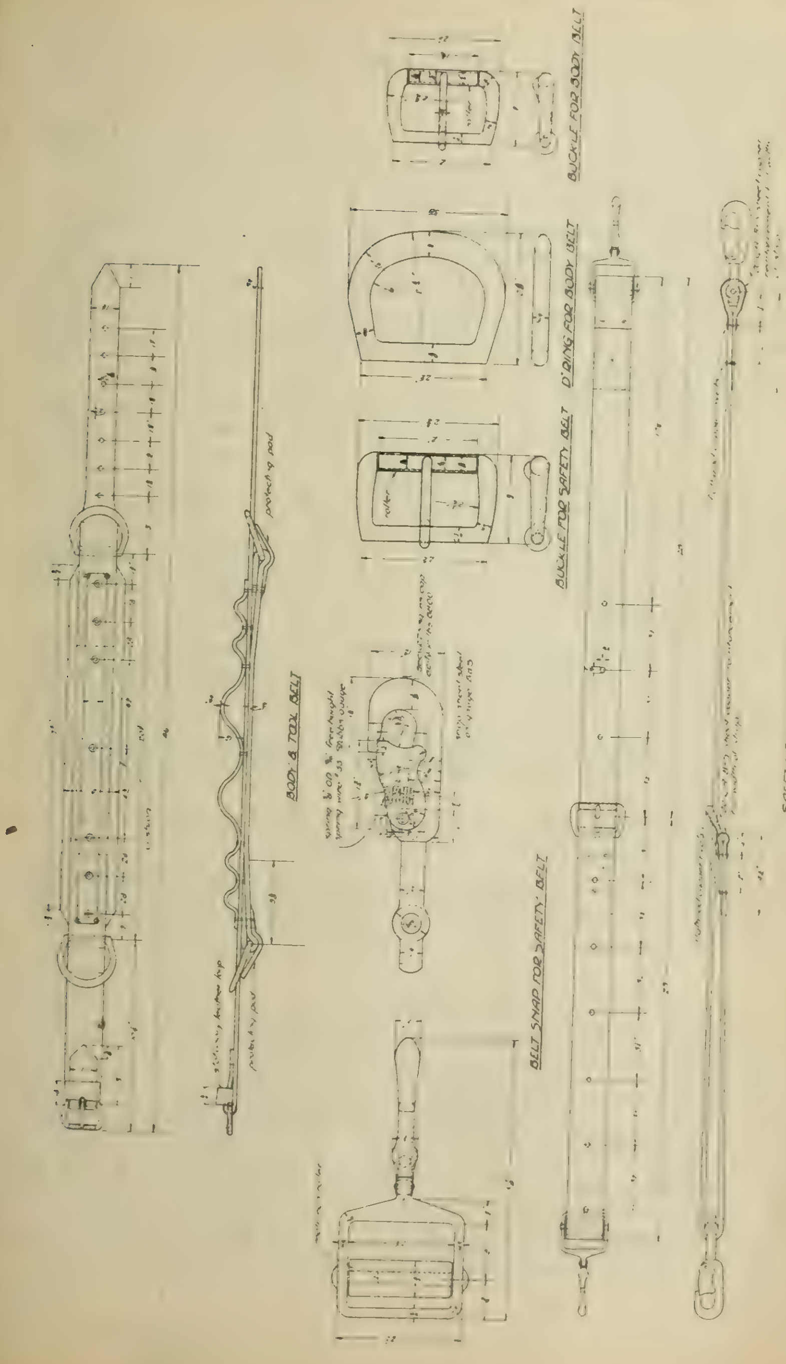
Immediately after manufacture, the completed belt shall successfully withstand a tension of 1,000 pounds, gradually applied between body and safety belts for one minute.

Rejection.

11. Belts made up of inferior materials, or not made in strict accordance with these specifications, or not meeting the tests prescribed in these specifications, will be rejected.

Materials.

12. All leather used shall be of the best grade oak tanned and black finished, cut from the back of the hide only, with the exception



LINEMEN'S BELT.

of that used for tool straps, loops and protecting pads, which may be cut from other parts of the hide, providing the leather is of good quality and of the thickness required. All cut edges shall be rounded off.

13. The "D" rings shall be made of malleable iron or drop forged steel, galvanized or japanned, and of the dimensions shown in the drawings or of equal circular cross section.

14. The buckles shall be made of steel, galvanized or japanned, and be of the dimensions shown in the drawings.

15. The snaps shall be made of malleable iron or drop forged steel, with the exception of the snap guard-hook, which may be of stamped steel, and all parts with the exception of the rollers shall be galvanized or japanned.

16. All rivets shall be of copper of ⅛" diameter.

17. The twine used for stitching shall be of the best quality linen.

Body Belt.

18. The body belt shall be not less than 2" wide from end to end and not less than 3/16" thick.

19. The cushion, which is secured to the inside and made a part of the body belt, shall be 3" wide and ¼" thick, tapered to a minimum of 2" to take the "D" rings.

20. The tool straps shall be not less than 1" wide and 3/16" thick.

21. The lengths for the different size body belts shall be as ordered.

22. The holes in the body belt shall be punched as shown in the drawings, and shall be elliptical, not over ¼" long, punched lengthwise with the belt.

23. The strap-keeper on the body belt shall be not less than 1" wide and ⅛" thick.

24. The buckle on the body belt shall have a cross-section diameter not less than ¼" in any part, with the exception of the tongue, which shall be 5/32" diameter.

Safety Belt.

25. The safety belt shall be not less than 2" wide and ¼" thick and shall be 6 feet in length, measured from the shaft of the outboard snap to the extreme end of the buckle.

26. The holes in the safety belt shall be punched as shown in the drawings and shall be elliptical, not over 5/16" long, punched lengthwise with the belt.

27. Reinforcements shall be of leather or of No. 20 B. & S. sheet metal 2" wide, rivetted as shown.

28. The buckle on the safety belt shall have a cross section diameter not less than 5/16" thick in any part.

Assembly.

29. All parts of the belt requiring stitching shall be double sewed. Stitching parallel to the edge shall be not less than ¼″ and not over ⅜″ from the edge of the narrowest member caught by the twine.

Body Belt.

30. Before attaching the cushion to the body belt, the eye forming the supports for the "D" hooks shall be made by tapering the cushion at each end, forming a lap extending back and between the cushion at least 4″. These laps shall then be sewed down each edge.

31. The belt and cushion shall then be sewn together along both edges, resulting in double stitching at the laps.

32. The tool strap shall be rivetted in, making the cushion belt and tool straps triple rivetted at each end, the first rivet from each end securing two thicknesses of cushion, the lap for the "D" ring eye, one thickness of belt and one thickness of tool strap.

33. The buckle eye-lap shall extend back 3″ with a 1″ taper on the outside of the belt and shall be sewed along the straight edge around the taper, the strap-keeper being sewed in at the same time.

Safety Belt.

34. One snap shall be laid in the loop of the belt while assembling.

35. The eyes forming the supports for the other snap-hook and for the buckle shall be made by tapering the belt at each end and forming a lap on the inside of the belt extending back a sufficient distance to permit of stitching the lap to the belt for a distance of 4 inches. After stitching the lap, the leather or metal reinforcing pieces shall be placed in position and rivetted.

36. The laps shall be triple rivetted. One of these rivets shall pass through the lap and belt near the end of the taper as shown, and the other two rivets will be used to secure the metal reinforcement which will be looped about the eye of the belt, the rivets passing through the lap and the reinforcement close to the eyes for the buckle and snap hook as shown.

Appendix 3.

HAMILTON ELECTRIC SAFETY FIRST ASSOCIATION.

In 1914 an Association known as the Hamilton Electric Safety First Association was formed, being composed of the different stringing wire companies in the city, as follows: Hamilton Hydro-Electric, Dominion Power & Transmission Co., Bell Telephone Company, C.P.R. Telegraph Co., G.N.W. Telegraph Co., Hamilton Fire Department, Hamilton Police Department.

The officers of the Association were: Chairman, Vice-Chairman, Second Vice-Chairman, Treasurer, Secretary, all of whom received

appointment by vote of ballot, except the Secretary, who was appointed by the Chairman.

In the case of the first three named companies, one representative was to be appointed by the company and the other to be elected by the employees.

Regular meetings were to be held at stated times, but due to the upset conditions on account of the war, when so many employees enlisted, it was exceedingly hard to carry out the work of the Association as would otherwise have been done. Meetings of the employees of the various companies were held, and they were addressed by myself, and it was pointed out to them that the Association had been formed equally as much to protect them as to protect the plants of the various companies. It was also pointed out to them that by reporting defective poles, crossarms, crosses between wires, or other defects, that accidents to persons and property might be avoided. With that thought in mind we enlisted the assistance of all the employees, and it was specially pointed out to them that no person was to be censured through any report of this nature having been made. In order that the reporting of unsafe conditions could be easily done, cards were placed in convenient places for the employees, such as storerooms, workshops, offices and at other points where they would be easy of access. These cards were then handed to their superior, who in turn mailed them to the Secretary of the Association. The Secretary then made out a report addressed to the company whose plant was at fault, calling their attention to the defect and asking them to remedy matters and report when completed.

The result of this Association was that stencils were purchased with the words "Safety First," and placed on all wagons, tool boxes, and poles located in a dangerous position, or in any other place where considered necessary.

There is no question but that considerable good resulted from this Association, as in the first one and a half years after its formation 219 unsafe conditions were reported and cleared.

The Executive comprised a representative from each of the first three named companies, and it was agreed in case of dispute as to the cost of clearing an unsafe condition that if the representatives of the company or companies could not agree that the third member of the Executive was to act as arbitrator and decide the matter. In the clearing of the 219 cases above referred to I would, however, point out that in no case was it necessary to arbitrate as to who should bear the cost of doing the work.

In addition to the stationery, a pledge card was printed, which read as follows:—

"I will do all in my power to guard against unsafe acts on my part. If I see a fellow employee doing his work in an unsafe manner, I will speak to him as a friend, and use my moral influence to have him perform his duties in the safest possible manner.

"I will remember and practice at all times Safety First."

In addition to the pledge, cards were distributed, which read as follows:—

"Every employee should report promptly to his Foreman, some member of Safety Committee or the other proper person, every unsafe condition in connection with any company's wiring or construction. **No one will be censured on account of such report.**"

J. H. MARTIN,
Division Plant Superintendent,
Bell Telephone Company, Hamilton.

Appendix 4.

RULES FOR RESUSCITATION FROM ELECTRICAL SHOCK BY THE PRONE PRESSURE METHOD*

Recommended by Commission on Resuscitation From Electric Shock, Representing The American Medical Association, The National Electric Light Association, The American Institute of Electrical Engineers—Revised by The National Electric Light Association, April, 1919.

Preface.

The First Commission on Resuscitation from Electric Shock, consisting of the members listed below, was organized during the year 1911 to consider the problems presented in resuscitation and in the determination of the best manual method of artificial respiration that could instantly be applied by laymen. Their report unqualifiedly recommended the Prone Pressure Method.

Personnel of the First Commission.

Dr. W. B. Cannon, Chairman, Professor of Physiology, Harvard University; Dr. George W. Crile, Professor of Surgery, Western Reserve University; Dr. Yandell Henderson, Professor of Physiology, Yale University; Dr. S. J. Meltzer, Head of Department of Physiology and Pharmacology, Rockefeller Institute for Medical Research; Dr. Edward Anthony Spitzka, Director and Professor of General Anatomy, Daniel Baugh Institute of Anatomy, Jefferson Medical College; Mr. W. C. L. Eglin, Past-President, National Electric Light Association; Dr. A. E. Kennelly, Professor of Electrical Engineering, Harvard University; Dr. Elihu Thomson, Electrician, General Electric Company; Mr. W. D. Weaver, Secretary, Editor "Electrical World."

The Rules for Resuscitation from Electric Shock, which were based on the findings of this Commission and were printed and distributed by the National Electric Light Association, have been widely

* These rules are published in booklet and chart form by the National Electric Light Association and the Canadian Electrical Association.

used and have, judging by the evidence presented, adequately fulfilled the purpose for which they were produced.

Certain questions respecting the method and the use of artificial respiratory and auxiliary apparatus have, however, arisen since the Rules were originally issued in 1912, and it was deemed advisable to organize a Third Resuscitation Commission to review the work accomplished and to make such further recommendations as the Commission might consider would be helpful. The personnel and proceedings and resolutions of this Commission are printed on page 36, and the study of the proceedings and the application of the resolutions by whom and whenever possible is urged in the interest of life conservation.

Upon receipt of the proceedings and resolutions of the Commission, the Sub-Committee on Accident Prevention, consisting of Mr. Charles B. Scott, Chairman, and Messrs. Magnus Alexander, R. L. Baker, P. H. Bartlett, H. J. Burton, H. B. Harmer, Wills Maclachlan, and W. T. Morrison, was requested to undertake the revision of the Rules for Resuscitation, which has been done with the thoroughness characteristic of the work of this Committee.

The revision of the Rules and also the Chart, which consists of an abbreviated form of these rules, has been based on field experience covering a number of years; and while no very radical changes have resulted, changes in detail have been made, which, it is felt, will make the operation of the method more effective, and to which the careful attention of instructors and those familiar with the method is directed.

(Signed) W. C. L. EGLIN,
Chairman Committee on Safety Rules
and Accident Prevention, N.E.L.A.

TREATMENT FOR ELECTRICAL SHOCK.

An accidental electrical shock usually does not kill at once, but may only stun the victim and for a while stop the breathing.

The shock is not likely to be immediately fatal, because:

(a) The conductors may make only a brief and imperfect contact with the body.

(b) The skin, unless it is damp with perspiration or wet, offers some resistance to the current.

The life of the victim depends upon the prompt and continued use of artificial respiration. The reasons for this are:

(a) The body continuously depends on an exchange of air, as shown by the fact that we must breathe in and out about fifteen times a minute.

(b) If the body is not thus repeatedly supplied with air, suffocation occurs.

(c) Persons whose breathing has been stopped by electrical shock have been reported restored after artificial respiration has been

continued for approximately four hours, and the treatment should be continuously applied until rigor mortis (stiffening of the body due to death) sets in.

The Schäfer, or "prone pressure" method of artificial respiration, slightly modified, is illustrated and described in the following resuscitation rules. The advantages of this method are:

(a) It is immediately available.

(b) Easy performance; no apparatus and little muscular exertion required.

(c) Larger ventilation of the lungs than by the supine method.

(d) Simplicity, the operator makes no complex motions and readily learns the method.

(e) No trouble from the tongue falling back into the air passage. The first impulse is expiration and any foreign substance in the mouth or air passage will likely be expelled.

(f) No risk of injury to the liver or ribs if the method is executed with proper care.

Aid can be rendered best by one who has studied the rules and has learned them by practice on a volunteer subject.

INSTRUCTIONS FOR RESUSCITATION.

Follow these Instructions Even if Victim Appears Dead.

I.—Free the Victim from the Circuit Immediately.

1. Quickly release the victim from the current, being very careful to avoid receiving a shock. Use any dry non-conductor (rubber gloves, clothing, wood, rope, etc.) to move either the victim or the conductor. Beware of using metal or any moist material. If both of the victim's hands are grasping live conductors endeavor to free them one at a time. If necessary shut off current.

Begin at once to get the subject to breathe (resuscitation) for a moment of delay is serious. Use "Prone Pressure Method" for four (4) hours if necessary, or until a doctor has advised that rigor mortis has set in.

Observe the Following Precautions.

(a) The victim's loose clothing, if dry, may be used to pull him away; do not touch the soles or heels of his shoes while he remains in contact—the nails are dangerous. If this is impossible, use rubber gloves, a dry coat, a dry rope, a dry stick or board, or any other dry *non-conductor* to move either the victim or the conductor, so as to break the electrical contact.

(b) If the bare skin of the victim must be touched by your hands, be sure to cover them with rubber gloves, mackintosh, rubber sheeting or dry cloth, or stand on a dry board or on some other dry insulating surface. If possible, use only *one* hand.

If the man receives a shock while on a pole, first see that his belt is secure around the pole, if possible above cross arm so victim

will not fall, then break the current. Pass a hand-line under his arms, preferably through his body belt, securely knot it, and pass the end of the line over the first cross arm above the victim. If you are alone, pass the line once around this cross arm. If you are not alone, drop the line to those at the base of the pole. As soon as the rope is taut, free the victim's safety belt and spurs and descend the pole, guiding the victim. When the victim is about three feet from the ground, lower rapidly so that the victim's feet hit the ground hard.

2. Open the nearest switch, if that is the quickest way to break the circuit.

3. If necessary to cut a live wire, use an axe or a hatchet with a dry wooden handle, turning your face away to protect it from electrical flash.

Fig. 1—Resuscitation by the Prone Pressure Method

II.—Attend Instantly to Victim's Breathing.

(1) As soon as the victim is clear of the live conductor, quickly feel with your finger in his mouth and throat and remove any foreign body (tobacco, false teeth, etc.) If the mouth is tight shut, pay no attention to the above-mentioned instructions until later, but immediately begin resuscitation. The patient will breathe through his nose and after resuscitation has been carried on a short time, the jaws will probably relax, and any foreign substance in the mouth can then be removed. Do not stop to loosen the patient's clothing; *every moment of delay is serious.*

(2) Lay the patient on his belly, one arm extended directly overhead, the other arm bent at elbow and with the face resting on

hand or forearm so that the nose and mouth are free for breathing. (See Fig. 1.)

(3) Kneel, straddling the patient's hips, with the knees just below the patient's hip bones or opening of pants pockets. Place the palms of the hands on the small of the back with fingers resting on the ribs, the little finger just touching the lowest rib, the thumb alongside of the fingers, the tips of the fingers just out of sight. (See Fig. 1.)

(4) With arms held straight, swing forward slowly so that the weight of your body is gradually brought to bear upon the subject (see Fig. 2). This operation, which should take from two to three seconds, *must not be violent*—internal organs may be injured. The lower part of the chest and also the abdomen are thus compressed,

Fig. 2 Resuscitation by the Prone Pressure Method

and air is forced out of the lungs, the diaphragm is kept in natural motion, other organs are massaged and the circulation of the blood accelerated.

(5) Now *immediately* swing backward so as to completely remove the pressure, thus returning to the position shown in Fig. 3. Through their elasticity, the chest walls expand, and the pressure being removed the diaphragm descends, and the lungs are thus supplied with fresh air.

(6) After two seconds swing forward again. Thus repeat deliberately twelve to fifteen times a minute the double movement of compression and release—a complete respiration in four or five seconds. If a watch or a clock is not visible, follow the natural rate of your own deep breathing, the proper rate may be determined by counting—

swinging forward with each expiration and backward with each inspiration.

(7) As soon as this artificial respiration has been started and while it is being continued, an assistant should loosen any tight clothing about the patient's neck, chest or waist. (KEEP THE PATIENT WARM.) Place ammonia near the nose, determining safe distance by first trying how near it may be held to your own. Then the assistant should hit the patient's shoe heels about twenty (20) times with a stick, and repeat this operation about every five minutes, until breathing commences. Do not give any liquids whatever by mouth until the patient is fully conscious.

(8) Continue artificial respiration without interruption (if necessary for four hours) until natural breathing is restored. Cases are on

Fig. 3 Resuscitation by the Prone Pressure Method

record of success after three and one-half hours of effort. The ordinary tests for death are not conclusive in cases of electric shock and doctors must be so advised by YOU, if necessary.

(9) When the patient revives, he should be kept prone (lying down)—and not allowed to get up or be raised under any consideration unless on the advice of a doctor. If the doctor has not arrived by the time the patient has revived, he should be given some stimulant, such as one teaspoonful of aromatic spirits of ammonia in a small glass of water, or a drink of hot ginger tea or coffee.

The patient should then have any other injuries attended to and be kept warm, being placed in the most comfortable position.

(10) Resuscitation should be carried on at the nearest possible point to where the patient received his injuries. He should not be moved from this point until he is breathing normally of his own volition, and then moved only in a lying position. Should it be necessary, due to extreme weather conditions, etc., to move the patient before he is breathing normally, he should be kept in a prone position and placed upon a hard surface (door or shutter) or on the floor of a conveyance, resuscitation being carried on during the time that he is being moved.

(11) A brief return of spontaneous respiration is not a certain indication for terminating the treatment. Not infrequently, the patient, after a temporary recovery of respiration, stops breathing again. The patient must be watched, and if normal breathing stops, artificial respiration should be resumed at once.

III.—Send for a Doctor.

If other persons are present when an accident occurs, send one of them for a doctor without a moment's delay. If alone with the patient, do not neglect the immediate and continued resuscitation of the patient for at least one hour before calling a doctor to assist in further resuscitation efforts.

A published, up-to-date list of doctors posted by the company is recommended.

IV.—First Care of Burns.

When natural respiration has been restored, burns, if serious, should be immediately attended to while waiting for the doctor to arrive.

A raw or blistered surface should be protected from the air. If clothing sticks, do not peel it off—cut around it. The adherent cloth, or a dressing of cotton or other soft material applied to the burned surface, should be saturated with picric acid (0.5 per cent.). If this is not at hand, use a solution of baking soda (one teaspoonful to a pint of water), or the wound may be coated with a paste of flour and water, or it may be protected with vaseline, carron oil, olive oil, castor oil or machine oil, if clean. Cover the dressing with cotton, gauze, lint, clean waste, clean handkerchief, or other soft cloth, held tightly in place by a bandage.

The same coverings should be lightly bandaged over a dry, charred burn, but without wetting the burned region or applying oil to it.

Do not open blisters.

THIRD RESUSCITATION COMMISSION—

(Under the Auspices of the Committee on Safety Rules and Accident Prevention of the National Electric Light Association)

PROCEEDINGS AND RESOLUTIONS

Edited by Professors Howell, Stewart and Thomson.

The Commission met in New York at the Rockefeller Institute, Friday, May 17, 1918.

There were present at the meeting: Passed Assistant Surgeon E. F. DuBois, U.S.N.R.F., of the Bureau of Medicine and Surgery, Navy Department; Dr. D. L. Edsall, Professor of Medicine and Dean, Harvard Medical School; Mr. W. C. L. Eglin, Chairman of Committee on Safety Rules and Accident Prevention of the N.E.L.A.; Dr. Yandell Henderson, Professor of Physiology, Yale University and Consulting Physiologist of the Bureau of Mines; Dr. Wm. H. Howell, Professor of Physiology and Assistant Director of the School of Hygiene and Public Health, Johns Hopkins University, Member of the National Academy of Sciences; Dr. Reid Hunt, Professor of Pharmacology, Harvard Medical School, Secretary of the Commission; Prof. A. E. Kennelly, Professor of Electrical Engineering at Harvard University and the Massachusetts Institute of Technology; Dr. Charles A. Lauffer, Medical Director of the Westinghouse Electric Company, Pittsburgh, Pa.; Dr. S. J. Meltzer, Rockefeller Institute, Chairman of the Commission, Member of the National Academy of Sciences; Dr. Joseph Schereschewsky, Assistant Surgeon General, U. S. Public Health Service; Dr. G. N. Stewart, Professor of Experimental Medicine, Western Reserve University, Cleveland; Prof. Elihu Thomson, General Electric Company, West Lynn, Mass., Member of the National Academy of Sciences; Lieutenant-Colonel Edward B. Vedder of the Army Medical School; Major Frank G. Young of the Ordnance Division of the War Department.

A telegram was received from Surgeon-General Gorgas that Dr. Charles H. Frazier, Professor of Surgery, University of Pennsylvania, is to represent his office. (In a subsequent communication Major Frazier accepted his appointment.) Conferees: Mr. P. H. Bartlett, Philadelphia Electric Company; Mr. Wills Maclachlan, Electrical Employers' Association, Toronto, Canada; Mr. C. B. Scott, Chairman of the Sub-Committee on Accident Prevention, N.E.L.A.; Dr. F. E. Schubmehl, General Electric Company, West Lynn, Mass.

The object of the Commission, the Chairman stated, is to consider efficient methods of artificial respiration in emergency cases, as they are met with in peace as well as in war. For more than a century, England has had several life-saving societies, and many special commissions have been appointed to investigate the methods employed in resuscitation. In this country, about six years ago, a Commission on Resuscitation from Electric Shock was created for the first time,

by the initiative of the National Electric Light Association. It is now generally recognized that efficient artificial respiration is, for such conditions, the best and practically the only means available for resuscitation. It requires but little consideration to realize that the need for an efficient means of artificial respiration is very widespread. For instance, in injuries to the head which stop respiration, injuries to the chest (especially double pneumothorax) in laparotomies during which the respiration ceases occasionally, in cases of shock which occur in peace and more so in the present war, in poliomyelitis with stoppage of respiration, in post-diphtheretic paralysis, in poisoning by opiates, by volatile gases (ether, chloroform, etc.) by mine and fuel gases, poisoning by magnesium salts, in electric shock and in drowning. The Committee on Safety Rules and Accident Prevention of the N.E.L.A., of which Mr. Eglin is the chairman, agreed that the Third Resuscitation Commission should consider its problems from a general point of view.

Mechanical Methods.—Dr. Meltzer demonstrated in the laboratory for physiology and pharmacology, the efficiency of the method of pharyngeal insufflation in an etherized dog after complete removal of the anterior wall of the thorax, in which the lungs and heart were exposed to full view. (18 minutes.)

Dr. Rossiter of the Carnegie Steel Company demonstrated the latest device of the Pulmotor Company, which is not identical with the original Pulmotor. He showed also the original Pulmotor. He stated that he had resuscitated eight gas cases, in which the respiration had stopped. This was done by the original Pulmotor in which he had more confidence. (30 minutes.)

Dr. James H. Booher, Medical Director of the Life Saving Devices Company, demonstrated the Lungmotor. He showed a number of blood-pressure tracings, taken from animals which had received artificial respiration by means of this apparatus. In reply to a question, Dr. Booher stated that in these experiments the Lungmotor was connected with the animal by means of a tracheal cannula. (In human cases the Lungmotor is applied by means of a face mask.) Dr. Booher left with the Commission histories of a number of cases in which the Lungmotor had been used (30 minutes). (The Commission found no time to examine these written histories, but Dr. Booher mentioned orally especially two cases. One of these cases was subsequently investigated by the Chairman. The life of a poliomyelitis patient with complete paralysis of the respiration was maintained for thirty-six hours by means of the Lungmotor. The reporting physician is of very good standing.)

In introducing Mr. Foregger, the Chairman explained that the physician who was most competent to present the details of the apparatus of the Foregger Company is now in France. Mr. Foregger was allowed fifteen minutes. The apparatus consists in modifications of the insufflation apparatus of Meltzer. Among other changes, the

apparatus carried an oxygen generator tank. In reply to a question, Mr. Foregger stated that the oxygen thus generated may last eight or ten minutes.

Manual Methods.—Mr. Eglin read a letter from Mr. M. W. Alexander, of the General Electric Co., stating that he hoped the "Commission would be very definite in recommending the prone-pressure method, as experience has proved its value."

Mr. C. B. Scott stated that the Accident Prevention Committee of the N.E.L.A. had reached the point in its investigation where it felt that the prone-pressure method was best to recommend, bearing in mind that machines are not always available in emergencies. His own company had had nine successful cases of resuscitation by the prone method and three unsuccessful cases in which mechanical means were used.

Dr. Schubmehl stated that the prone-pressure method has been most successfully aplied by their two hundred and twenty-five First-Aid Men.

Mr. Maclachlan stated that he had the duty of training possibly three thousand men in the prone method. Their system required the men to practice this method at least once a month. The men are instructed not to desist in less than three and a half hours, and that not till then should they listen to advice from a physician who might tell the operator that the patient was dead.

The Secretary read the following parts of a letter from Professor Shäfer, of Edinburgh, to the Chairman: "The prone method has been adopted **exclusively** for about twelve years by the Royal Life Saving Society, the only important organization in the British Empire whose object is the resuscitation of the apparently drowned. It has also been adopted for several years by the London and other police forces, by the Board of Trade, by the Army and the Navy." "The most important thing is in cases of drowning to have something ready which any man can use; which will effect respiratory exchange—whether exactly as much as normal, matters very little."

Resolutions Adopted by the Commission.

In the discussion following the presentation of methods and evidence to the Commission, the following important facts were emphasized:

1. That in most accident cases no resuscitation apparatus is at hand for immediate use.

2. That reliance upon the use of special apparatus diminishes greatly the tendency to train persons in the manual methods and discourages the prompt and persevering use of such methods.

3. That police officers or physicians often interfere with the proper execution of manual methods, in that they direct that the patient be removed in an ambulance to some hospital, thus interrupting the continuance of artificial respiration.

4. That in many hospitals the members of the staff are not all acquainted with the methods of artificial respiration.

5. That in medical schools instruction is not properly provided for students in the manual methods of artificial respiration.

In view of these facts the following resolutions were adopted by the Commission:

1. The prone-pressure, or Schafer method of resuscitation, is preferable to any of the other manual methods.

2. Medical Schools, Hospitals, Fire and Police Departments, the Army and Navy, First Aid Associations, and industrial establishments in general, should be urged to give instruction in the use of the prone-pressure method of resuscitation.

3. Individuals who, from accident or any other cause, are in need of artificial respiration, should be given manual treatment by the prone-pressure method immediately on the spot where they are found. It is all important that this aid be rendered at once. The delay incident to removal to a hospital or elsewhere may be fatal, and is justifiable only where there is no one at hand competent to give artificial respiration. If complications exist or arise, which require hospital treatment, artificial respiration should be maintained in transit, and after arrival at the hospital, until spontaneous respirations begin.

4. Persons receiving artificial respiration should, as much as possible, be kept warm and the artificial respiration should be maintained till spontaneous breathing has been permanently restored, or as long as signs of life are present. Even in cases where there is no sign of returning animation, artificial respiration should be kept up for an hour or more.

5. A brief return of spontaneous respiration is not a certain indication for terminating the treatment. Not infrequently the patient after a temporary recovery of respiration stops breathing again. The patient must be watched and if normal breathing stops, the artificial respiration should be resumed at once.

6. Artificial respiration is required only when natural respiration has ceased. In cases of simple unconsciousness from any cause in which natural respiration continues, artificial respiration should not be employed without medical advice.

7. The Commission recommends that in cases of gas asphyxiation, artificial respiration, whether given by a manual method or by special apparatus, should be combined when possible with the inhalation of oxygen from properly constructed apparatus.

8. With regard to the employment of mechanical devices for artificial respiration, the Commission feels that it ought not at present to take a definite stand, either for or against any particular form of apparatus. However, the Commission recommends, that the use and installation of apparatus should be confined, for the present, to properly equipped institutions under medical direction. The Commission recognizes the great need of simple

devices capable of performing artificial respiration reliably and efficiently. It therefore recommends a careful study of the problem, directed toward the development of a reliable method appropriate for general adoption. (See appendix below.) Such studies can best be carried on in properly equipped hospitals and labaratories which offer opportunities and facilities for critical observation and experimentation.

In view of the importance which the knowledge of proper methods of resuscitation possesses for public health and safety, and considering the fact that many practitioners, members of hospital staffs and graduates of medicine are not thoroughly familiar with the methods of resuscitation, especially that of the prone-pressure method, the Commission recommends:

(a) THAT MEDICAL JOURNALS (and other scientific and practical journals which are interested in the problem of resuscitation) BE ASKED TO PUBLISH THE RESOLUTIONS ADOPTED BY THE COMMISSION.

(b) THAT A COPY OF THESE RESOLUTIONS BE SENT TO THE MEDICAL COLLEGES WITH A REQUEST THAT PROPER INSTRUCTION IN THIS SUBJECT shall be arranged for in the College Schedules.

(c) That these resolutions be sent to as many hospitals as possible, with the recommendation that members of the house staff shall familiarize themselves with the methods of resuscitation.

(d) In order that the resolutions of the Commission may be brought to the attention of interested circles (fire and police departments, industrial plants, etc.), it was agreed that they be communicated to the Associated Press (by the National Electric Light Association).

It was voted that the Third Resuscitation Commission should be properly organized and continue its existence, ready to respond when requirements arise. The following officers were elected:

President—Dr. S. J. Meltzer.

Vice-President—Dr. Yandell Henderson.

Secretary—Dr. Reid Hunt.

Treasurer—Mr. W. C. L. Eglin.

It was voted to appoint a committee for the collection of verifiable data relating to resuscitation. The President appointed to the committee:

Dr. D. Edsall—Chairman.

Dr. Reid Hunt—Secretary.

Prof. Elihu Thomson, and the President Ex-Officio.

Appendix.

The Commission consists of fifteen members. Fourteen approved the foregoing report without qualifications. The fifteenth member wishes to qualify his vote by the following:

Statement.

Dr. Yandell Henderson qualifies his support of the resolutions as follows:

While I concur in a considerable part of the report of the Resuscitation Commission, I dissent from the statement in Resolution 8, recognizing "the great need of simple devices capable of performing artificial respiration reliably and efficiently."

Devices which are excellent from the mechanical standpoint are now available and widely sold; but the evidence regarding them indicates clearly, I believe, that even if these devices were on the spot where several gassings or electrocutions occurred, and if all the victims were treated with them, except one who was given manual (prone pressure) treatment, this one would have much the best chance of recovery. In actual practice the apparatus is seldom right on the spot adjusted and ready. Critical time is lost, and thus in the above suppositious cases, as they actually occur, the only victim with any considerable chance of resuscitation (aside from those who recover spontaneously and are credited to the apparatus) is the one treated manually.

Even more important is the fact, demonstrated now by universal experience, that when apparatus is known to be obtainable, it is sent for and the manual method neglected. Thus, to-day the apparatus in public use is on the whole contributing very materially to decrease the saving of life.

The next item on the programme is Report of Committee on Prime Movers. We shall not have the pleasure of hearing it read by the gentleman whose name appears on the programme, but we shall have the other pleasure of hearing it read by Mr. R. J. Beaumont who, I understand, if I may mention a secret, has edited the paper but has not largely added to its volume I understand.

REPORT OF PRIME MOVERS' COMMITTEE.

S. Svenningson, Chairman.

Mr. President and fellow Members:

Your Committee, in presenting this report, regret that it does not contain more data. Through one cause or another the members of the committee were delayed in getting down to serious work until late this spring, and we therefore ask the indulgence of the members of the Association if our report is not just what it should be.

During the period of the war one of the features in the manufacturing life of this country was the plentiful supply of electrical energy available through the development of our wonderful water power resources and the consequent conservation of fuel. This report deals with chiefly Steam Power and Water Power, as we have been unable to obtain data on gas and oil engines.

In Canada the plentiful supply of electrical energy supplied from Hydro-Electric sources, and the necessity of conserving the fuel supply of the country during the period of the war, has turned the minds of all engineers and manufacturers to the necessity of economy in the operation of steam generating plants, and the efforts of designers and operating engineers have been concentrated on improvements in this direction.

Considerable progress has been made in late years in the science of generating steam, due to a better understanding of the combustion of fuel and the transmission of heat in boilers.

Mr. F. A. Combe, of the Babcock & Wilcox Co., in a paper entitled "Modern Boiler Practice," calls attention to the fact that though no radical changes in boiler construction have taken place, yet improvements have been developed in the arrangement of boiler heating surface due to more efficient furnaces, boiler settings and plant operation.

Present day tendencies favor high steam pressures and temperatures, concentration of power and large unit capacities. The shell boiler has been practically eliminated for this class of service, and modifications have been made in the setting and rating of water tube boilers. Existing conditions encourage the use of boilers of high efficiency and rating.

The application of insulating brick in boiler settings is now becoming better understood. It is generally accepted that the walls of a boiler furnace should be built of as few different kinds of material as possible, and walls should be well bonded and homogeneous. Recent tendency has been to build walls of solid fire brick.

In order to preserve the furnace side and bridge walls various expedients have been tried. What is required is a furnace lining capable of withstanding the high furnace temperatures and blow torch action; the constant heating and cooling effect and abrasive action of the fuel bed.

Ventilated walls, special refractory materials, steam jets on side walls and high temperature cements have all been used with varying success.

The present tendency is towards higher boiler ratings. One of the principal factors involved in high boiler rating is the coal burning capacity of the grate, or in other words stoker and furnace design. Draft loss at high boiler ratings is an important item to be considered and the character of the boiler feed water may readily become a factor in boiler ratings.

We cannot attempt to treat this subject fully in this report. The local test as to whether a boiler is priming lies in the quality of the steam leaving a boiler or in the temperature of the steam leaving the superheater. A recording thermometer on steam outlet from superheater will indicate priming by sharp fluctuations on the superheat temperature curve.

Power dump grates and clinker grinders seem to be coming into use. The Westinghouse Co., and American Engineering Co., have these on the market, as well as several other concerns.

The forced draft type of chain grate is now being used more extensively with success in burning low grade fuels high in ash.

We regret being unable to furnish any data in reference to superheaters, economisers and condensers.

Regarding meters, indicators and instruments, general progress in their development has been normal.

Higher steam pressures have been tried out in one or two plants in the United States.

The Buffalo General Electric Co. have recently placed in service a plant operating at 275 lbs. boiler pressure, 275 degrees superheat giving a total temperature of 689° F.

The Public Service Co., of Northern Illinois, have an installation operating at 315 lbs. boiler pressure, 225 degrees superheat giving a total temperature of 615° F.

The general impression seems to be that the question of higher steam pressures is a boiler problem and that turbines can easily be designed for operation at the higher pressures.

We are including as follows a description of the Heine Cross Drum Boiler. These boilers are now being built in sizes up to 10,000 sq. ft. of heating surface.

Specifications for Heine Cross Drum Water Tube Boiler.

This boiler is of the horizontal cross drum water tube type designed to have the following distinctive advantages:

(1) Free steaming capacity and ability to withstand severe overloads. (Obtained by a pronounced pitch of tubes, large waterleg areas, specific provision for promoting return circulation at top of bank of tubes and separation of steam.)

(2) High efficiency of combustion and absorption of heat from the hot gases. (Baffle tile may be placed on the lower row of tubes to form a roof of the combustion chamber in which volatile gases may completely burn before reaching the comparatively cold boiler surfaces. Or lower baffle may be placed on the third row of tubes with boilers used in connection with those forms of furnaces that make this arrangement preferable. The hot gases enter the main part of nest of the boiler tubes and flow substantially parallel to them. This trend of the gases has been demonstrated to give the highest rates of heat transmission.)

(3) A large proportion of the scale-forming impurities of the feed water are deposited in the feed water purifier, and mud drums are thus prevented from being deposited on the boiler heating surfaces. (This purifier and mud drum is located in the drum or shell of the boiler, and is partially submerged. It is to be distinguished from the ordinary mud drum, which is solely a receptacle for the ac-

cumulation by gravity of the impurities already precipitated within the boiler, whereas with this design the water cannot enter the general circulation of the boiler until it has been at least partially purified, nor can the deposited solids be hardened by heat, but can easily be blown off in the form of a sludge.)

(4) An efficient soot blowing system is provided as a permanent part of the boiler. (The design of the Heine boiler lends itself to the application of a highly effective soot blower, doing away with the necessity of blowing soot by means of a laboriously operated hand lance through doors in the side walls.)

(5) By reason of the compact arrangement of the heating surface this boiler requires but a minimum amount of floor space and headroom compared with other types of horizontal or inclined vertical water tube boilers. (Many horizontal water tube boilers require as much as 40% more floor space and considerable more headroom than the Heine boiler. Many boilers of the inclined vertical water tube type require as much as 25% more floor space and 50% more headroom.)

(6) As access to the interior of the boiler setting through the side walls is not necessary with the Heine boilers, any number may be set in a single battery except in so far as this arrangement may be limited by the requirements of certain types of stokers, building columns, etc. Besides saving in space, a number of boilers set in a solid battery are immune from much of the loss due to air infiltration and radiation.

(7) The absence of side cleaning doors greatly reduces air leakage, regardless of how the boilers may be set, and insures a high percentage of CO^2 and consequent coal economy.

(8) Boilers are built by expert workmen in a modern shop, equipped particularly for the production of boilers of this type, and of the best materials procurable.

Materials.—The header boxes and drums are built entirely of fire box steel plate, staybolt tubing and tubes made especially for us of quality strictly in accordance with the requirements of the American Society of Mechanical Engineers Boiler Code. Test certificates are kept on file for reference at any time. No cast metal is used in any part of the boiler subject to tensile strength.

Shell.—The shell is cylindrical in shape, made of a single sheet (except in the case of exceedingly large boilers), the thickness of the plate and design of the joints being strictly in accordance with the requirements of the A.S.M.E. Boiler Code. The longitudinal seams are double strapped butt joints. The heads are rivetted in with single rivetted lap joint. The exact design of all rivetting depends, of course, on the pressure to be carried. The heads are dished to a radius equal to the diameter of the shell so as to require no internal staying. One head is provided with a reinforced flanged-in manhole with a pressed steel cover and yoke, except that in those cases where

more than two boilers are set in a battery, the manholes of all but the outside boilers are located in the shell proper instead of the head.

Two rows of tube holes are bored in the shell for the reception of the tubes and nipples connecting the shell to the header boxes. There are also provided the forged steel pads for the feed blowoff and the water column connections, and pressed steel saddle flanges for the safety valve and main steam outlet. These saddles and pads are carefully forged to fit the shape of the shell, and are threaded or provided with stud bolts for the proper fastening of the connections.

Header Boxes.—The header boxes are made of steel plate, flanged along the top and bottom edges, with a long radius turn, the two sheets being lapped and rivetted together with a single row of rivets, without a butt strap. The ends of the boxes are closed by means of a trough shaped plate of proper shape to fit into the open ends of the joined plates and rivetted thereto. These end plates are flanged hydraulically at a single heat.

The header boxes are stayed by means of hollow staybolts of carefully tested seamless tubing of large diameter screwed into tapped holes in the tube plates, the projecting ends being carefully upset on the outside.

The tube and hand holes are carefully bored to exact diameters.

The plates are carefully annealed before being joined together. Each header box, when completed, is ready for assembling.

The upper parts of the tube sheets have a flat strip at an angle with the balance of the sheet, in which are located the holes for the tubes and nipples connecting the header boxes to the drum, in such a way that the tubes and nipples enter at right angles to the plate.

While this part of the boiler is similar to other makes, a close inspection will disclose very superior detailed construction.

Tubes.—The tubes used are of the best quality lap welded mild steel, made especially for us, $3\frac{1}{2}''$ in diameter and of length as specified. The tubes extend through the tube sheets of the header boxes into which they are expanded with roller expanders.

Tube Holes and Hand Holes.—Opposite the ends of the tubes are the hand holes and the outer plates of the boxes. These holes are slightly larger in diameter than the tubes, to permit the replacing of tubes if necessary. The hand holes also provide means for efficiently cleaning the interior of the tubes. These hand holes are closed by devices, of which there are several types, cast iron or drop forge plates and gaskets making a joint from the inside or the Key hand hole cap.

Internal Fittings of Shell.—Within and at the top part of the shell, extending nearly the whole length thereof, is a dry pipe. This pipe is provided with a large number of small holes in the upper part, and is connected, steam tight, to a steam outlet saddle.

Attached to the side of the shell, well above the horizontal tubes connecting the shell to the rear waterleg, is a curved deflection plate which extends below the waterline and against which the water and steam issuing from the tubes is discharged. The steam separates and passes from under this deflection plate at the ends, as the plate does not extend the whole length of the shell.

A partially submerged feed water purifier and mud drum is located on the opposite side from the deflection plate. This mud drum is so designed as to thoroughly heat up the feed water to the temperature of the steam. The drum is sufficiently long, and the direction and rate of flow such as to give ample time for the settling out of mechanically mixed impurities, and for the precipitation of at least a considerable part of the dissolved impurities which are thrown down at high temperatures. The feed flows out of this mud drum from below the surface, so that any oil that accumulates on the top does not go into the general circulation. The impurities thrown down remain in the form of a sludge, since this device does not come in contact with any high temperatures and may be discharged at regular intervals through the blowoff. Any accumulation of oil is likewise blown off when the mud drum is emptied.

Soot Blowers.—The soot blower system consists of a series of small steam nozzles inserted through the hollow staybolts of the rear head with auxiliary sets of nozzles so located as to stir up and dispose of any accumulations of soot or ashes on the baffle tile. The main series of jets is designed to create an intense momentary draft which dislodges accumulations of soot and dust from the boiler surfaces, directing it to the uptake.

Boiler, Front.—The front is of an ornamental design, the lower part of the fire front being of heavy cast iron, while the upper or purely ornamental part is of light wrought steel construction. The casing doors give access to the outsides of the header boxes for the purpose of cleaning and other necessary attention. All necessary buckstays, cleaning doors, anchor rods, etc., are provided.

Support and Setting.—Usually the steam drum, and consequently the lower header box, is in the front of the boiler, although it is quite possible to reverse this arrangement in order to save headroom.

The front end of the boiler is carried by means of columns which are secured to lugs, which in turn are rigidly rivetted to the end plates of the header box. The columns can be made of any length so as to give the desired height of furnace.

The rear waterleg is carried by means of columns fastened through suspension straps to the lugs rivetted to the end plates of the header box, thus giving a flexible connection which provides for the inevitable movements due to expansion and contraction induced through temperature changes. The whole is enclosed by brick side walls and rear wall underneath the rear header box. The top is closed by means of tee bars extending from wall to wall, and which

carry a fire brick and insulating covering. All parts of the brick setting exposed to hot gases are of fire brick. In cases where it is desired to use a stoker the ordinary fire front is, of course, omitted.

Baffle Tile.—Baffle tile are designed to rest on and between the tubes of the rows on which it is desired to place them. They extend from one header to within a short distance of the opposite one. There are various arrangements of the tile possible so as to provide for varying conditions.

The simplest arrangement is to put the lower baffle on the lower row of tubes and the upper baffle on the upper row of tubes, giving a single pass of the gases through the tube nest.

Another arrangement is to put the lower baffle up on the third row of tubes, thus giving a partial pass through the lower row of tubes and a complete pass through the balance of the nest of tubes. Still another arrangement is to have either of the above arrangements as to the lower baffle and introduce another baffle a little more than halfway up the height of the tube nest, thus giving two full passes through the nest of tubes.

The choice of the arrangement of baffling depends upon various conditions under which the boilers are to be installed.

Fittings and Trimmings.—Each boiler is provided with a pop safety valve of the proper size. Reliance high and low water alarm column with quick acting shutoff device operated from the floor by chains, and three tri-cocks. Steam gauge is attached to the boiler front and feed check and blowoff valves, and provided and located for easy access and convenient manipulation.

Steam Turbines.

In recent years there has been a marked tendency towards the installation of units of large capacity, and during the past two years there has been a marked increase in the United States in units of the horizontal shaft type of approximately 30,000 kw. capacity, in order to meet the rapidly increasing density of the load. The Prime Movers Committee of the N.E.L.A., in their report for 1919, have included a list of large unit installations which is of considerable interest.

The main sources of trouble in large steam turbine units seem to be in the labyrinth packings and thrust bearings, which are apt to cause excessive vibration of parts; the breaking of buckets, dangerous rubbing of stationary and moving elements, which, in extreme cases, may result in permanent deflection of the shafts.

The following, from the General Electric Co., in reference to Turbine-Generators, will probably be of interest:

Since our last statement two years ago in reference to turbines, war conditions have, of course, made the undertaking of new commercial development on a large scale very difficult. It was necessary, nevertheless, to carry through the new designs on which we had

already started, and to do a great deal of development work to meet the requirements of the Navy and Emergency Fleet Corporation.

At a time when we were hard pressed for skilled labor of all kinds it was extremely difficult to give the time and attention necessary to the development of new designs. The Engineering and Manufacturing Organization could not be expanded quickly enough, by the addition of thoroughly trained men, to fully meet the enormous demands which suddenly came upon us. We, like all other manufacturers, suffered severely on account of the loss of skilled men who went in the service; over 8,000 employees leaving us on this account. These men had to be replaced by less skilled men, and in addition a greatly increased force recruited from all sources.

We also experienced great difficulty in securing the quantity and quality of materials required for the manufacture of turbines. The producers of all lines of materials and accessories were surfeited with business, were required to carry on production under the same disadvantages as we suffered from, and in endeavoring to meet the demands for maximum production, undoubtedly encountered most serious obstacles in the way of maintaining quality equivalent to pre-war standards.

The severe handicaps under which we were working were necessarily reflected to some extent in the turbines manufactured during this period of stress, and a number of machines have been subject to trouble of one kind or another. Cases of trouble have not, by any means, been confined to turbines of new types, but have occurred to recently built turbines of the older types.

Actual experience was required to show that our inspection system, which had previously proven to be amply protective, was not, under the new conditions, sufficiently thorough or comprehensive, and it has been necessary to elaborate it. This has been done, and with the return to more nearly normal conditions the severe handicaps under which we have been working during the last two years are being removed. We feel greatly encouraged by the results already attained, and have the utmost confidence that, from this time on, the production and operation of Curtis Steam Turbines will be on the same satisfactory basis as existed in former times. No radical changes in existing designs of turbines are contemplated.

A very large number of turbines and gears has been furnished to the Emergency Fleet Corporation for propelling cargo boats and to the U. S. Navy for destroyers. In addition, turbine generators have been supplied and are on order for the electric propulsion of large war ships for the Navy. For the latter purpose turbine generators of individual capacity up to 35,000 kw. are on order.

The company has built and will continue to build direct current turbine generators, also turbine generators for special application, including steam extraction, low and mixed pressure units, and turbines for mechanical drive.

A line of turbines particularly for mechanical drive applications, and known as the type "L," was developed about three years ago. Since that time there have been sold over 90,000 horsepower for this class of service alone, the number of machines being between 800 and 900. The operating record of the machines has been exceptionally good.

The line of turbines includes machines from 10 to 500 horsepower, at speeds up to 3,600 r.p.m. Any steam pressure and superheat may be used up to the highest in commercial use in large stations.

These turbines meet two conditions:

First, that individual machines are designed to suit each customer's particular operating conditions; and,

Second, that the foregoing can be accomplished with a machine made up from parts manufactured on a quantity basis.

Both of the above ideas are carried out, and the type "L" machine combines a machine designed to meet any given set of conditions, and, at the same time, one which is built on a quantity production basis.

Each machine is made up of standard parts, which are, in the main, as follows:

Nozzle plates, shaft and wheels, high pressure heads, wheel casings, exhaust heads, operating governor, governor valve, emergency valve.

Nozzle plates are made up in quantity, but the nozzles are not drilled until an order is received. The shop is equipped with engineering data to make nozzles suitable for use with wheels having buckets of different heights, and for each height there are reamers available giving nine expansion ratios. A machine, for example, can be equipped with from one to fifty small nozzles, or from one to twenty-eight large nozzles, and each one of these nozzles may be furnished with any one of nine expansion ratios. The ratio of areas possible between one small nozzle and the maximum number of large nozzles is 1 to 90, and, as may be figured from the above data, the progress from the smallest to the largest area can be made in 702 separate steps. It will easily be seen from the above that the statement that the nozzle is designed specifically for the customer's conditions is correct for all practical purposes.

The wheels are made up with different bucket heights, and each bucket height is made with two sets of bucket angles, known as the high speed and low speed combination. Any of these may be supplied with clockwise or counter-clockwise rotation. Or, in other words, there are a number of different standard bucket wheels carried in production. Any of these may be supplied with alloy or steel buckets, depending on temperature conditions, and any wheel or combination of wheels may be assembled, depending on whether a one, two or three stage turbine is required. Three shafts are provided to take care of machines having different number of stages.

A high pressure head with a short nozzle arc is used for small horsepowers, high steam pressures, or for such conditions as require a small number of nozzles. This head is furnished in steel or iron, depending on temperature conditions. A long arc head is used when more nozzles are required than can be assembled with the short arc head, or in all cases where a hand valve is required. This head is also furnished in iron or steel, depending on conditions.

An exhaust head with 8″ diameter exhaust is used on all machines having a steam flow up to the capacity of the 8″ opening. A 14″ head is used for steam flows beyond the capacity of the 8″ head. The 14″ head may be furnished either right or left hand or looking downward.

The diaphragms are furnished in either steel or iron, depending on steam temperature and pressure conditions. On receipt of customer's order, the diaphragms are drilled with the proper number and kind of nozzles.

The operating governor is furnished for speeds from 1,200 r.p.m. to 3,600 r.p.m. by using various combinations of standard weights and springs, and when assembled for a given normal speed may be adjusted while the machine is running, for a considerable range of speed from normal.

The operating governor and valve are assembled, with the governor lever as well as with a hand wheel, by which the speed of the machine may be regulated while the turbine is in operation. To accomplish this speed change, the regulation of the governor is made broad, i.e., there is a wide variation in speed between the speed at which they have reached their maximum travel. The movement of the weights is several times that necessary to move the governor valve from entirely open to entirely closed. Consequently, by moving the hand wheel, the operating range of the governor may be adjusted at any position between the minimum and maximum speeds determined by the movement of the weights.

From the foregoing description it will be evident, although the type "L" machine is in general made up from a very few parts, that there are a number of variations to each part, and that the number of combinations which can be made is practically infinite; or in other words, that it is no exaggeration to say that each machine is designed exactly for the conditions for which it is sold.

All machines, whether built with one, two or three stages, have the wheel casing split, so that the top half of the casing may be lifted without disassembling the machine and the bucket wheels and nozzles readily inspected. The turbines may be furnished with a speed control governor or with a safety stop only, for cases where the turbine is used to drive a boiler feed pump, and the speed is controlled by a water pressure regulator. Both governors may be supplied if required, and the steam inlet may be supplied vertically, thus making a ma-

chine well suited for use in cramped positions where space is at a premium.

In order to produce type "L" turbines in accordance with the plan laid out, it has been necessary to equip a new shop for the manufacture of these units, where all operations have been standardized, and where a large number of special machine tools have been installed to permit rapid and economical manufacture.

The type "L" turbine has been sold largely for use in driving pumps of various kinds, but is well adapted for driving any of the auxiliary apparatus in a central station. The design has been thoroughly standardized and tested by several years of operation under all sorts of operating conditions, and the type "L" turbines have been found to be uniformly satisfactory.

We have not received any written statement from the Westinghouse Company as to their activities in the steam turbine field, but can safely say that this concern has kept step with the progress in this industry along with other large manufacturers.

An interesting paper on Steam Turbine Progress was issued in May, 1918, by the Westinghouse Company, entitled "An Historical Review of Steam Turbine Progress," by Francis Hodgkinson.

Gears.

Considerable progress in the development of reduction gears has been made of late years. In large capacities 750 horsepower and upwards, gears have been in operation for some years as a reduction medium for connecting moderate speed steam turbine and low speed direct current generators and centrifugal pumps.

Water Power Turbines.

During the four or five years' period prior to the war the manufacturers of hydraulic turbines made great strides in developing units of high efficiency and simple designs. This was primarily obtained through the introduction of the high specific speed single runner units. During this period a great number of low head plants were built, using single runner units of larger size than anything previously attempted. During the last four years, however, the activities in hydro-electric developments were greatly lessened and few new features in design have come out, although a certain amount of research work has been carried out, the benefit of which should be realized in the near future.

Efficiencies of 92 to 93 % on runners have already been obtained in several plants, and we may assume that this is very near the maximum efficiencies that can be expected; but, in order to obtain a maximum over all efficiency of plants, hydraulic turbine engineers are now carefully looking into the design of all passageways from headrace to tailrace. Particular attention is being paid to the design and efficiency

of draft tubes for high specific speed runners. The tendency is towards the use of deeper draft tubes, with the idea of making the turn from the vertical to the horizontal direction at lower velocities than was previous practice.

It is also generally realized that improvements can be made in the design of intakes, especially for low head plants.

Mr. F. H. Rogers, Hydraulic Engineer, I. P. Morris Dept., Wm. Cramp & Sons, Ship & Engine Building Company, touched upon an important subject with regard to losses that may occur in hydraulic turbines in his article, "Economical Operation of Water Turbines," printed in "Electrical World," April 5th, 1919.

There seems to be a difference of opinion as to the number and size of units to be installed in a projected plant; the tendency has been to look upon the water turbine as an almost fool-proof piece of machinery; consequently, plants have been equipped with as few and as large units as possible, thereby making considerable saving in first cost, as well as operating expense. Considering, however, that the reliability of a unit does not only depend upon the water turbine, but also on the generator and auxiliaries, some designers of power plants incline towards comparatively small units, with less chance of shortage of power in case of break-downs. The question as to size and number of wheels to be installed in a plant must, of course, also be decided upon with regard to the transmission system and importance of continuous service.

Runners.—The single runner vertical shaft units for low and medium head plants have proven to be of such a success that practically all new plants under this category are now being equipped with this type of units.

Turbine manufacturers are constantly experimenting with higher specific speed runners, in order to meet the demand from customers for large units operating under low heads. While a few years ago a specific speed of 100 was considered high, manufacturers claim to-day to be able to build low head units with a specific speed of 170.

Thrust Bearings.—With the increase in size of large vertical water wheels and the consequent increase in weight of the rotating parts, the importance of satisfactory thrust bearings cannot be exaggerated, and a great deal of progress has been made in recent years.

The General Electric Co., Spring Thrust Bearing.

The General Electric Company, Schenectady, N.Y., have developed a spring-supported thrust bearing in an effort to overcome certain difficulties experienced in the operation of thrust bearings on this character of service.

The main features of the spring supported thrust bearing is that it automatically adjusts itself to unequal loading, due to inaccuracies in workmanship or in alignment. A distinctive feature of this bearing is that it will automatically adjust itself while in operation if there

is a loss of alignment due to settling of the foundation or to other causes.

The bearing is not affected by wobbling of the shaft. The rubbing surfaces are in a bath of oil, and the quantity of oil circulated from an outside source depends on the losses and the cooling conditions. Water cooling coils may be installed in the bearing housing, which will reduce the amount of oil, and in certain sizes of bearings at low speed, no circulation of oil from a source outside the bearing housing is required.

The salient features of the spring supported thrust bearing are:

A thrust collar keyed to the shaft which transmits the weight of the revolving parts to the rotating ring of the bearing. This rotating ring has a smooth rubbing surface and is so designed that a rapid circulation of oil is maintained.

There is also a stationary ring, the upper surface of which is the stationary rubbing surface of the bearing. This ring rests on springs, and to ensure flexibility it is made thin and has a radical saw cut through one side.

Sufficient springs are provided so that the stress is only about one-half that usually used, and the deflection under load is about 0.1 inch.

Cooling coils are used to carry off a part or all the heat generated between the rubbing surfaces of the bearing. Centre pins hold the springs in position. An oil well tube is provided, which forms the inside annular wall of the oil chamber and is welded to its supporting ring. Dowel pins keep the stationary ring from revolving.

Two of these bearings have recently been installed in the Cedars Rapids plant of the Montreal Light, Heat and Power Consld., in connection with the last two 10,800 h.p. units, and have now been in operation for some months and have given entire satisfaction.

These bearings are designed to sustain a load of 550,000 pounds during continuous operation of the generating units at a normal speed of 55.6 r.p.m. A good grade of lubricating oil, well filtered and free from water or entrained air, and at a temperature not greater than 43 deg. C., maintained at a level above the sliding surfaces is used, and under these conditions bearings can carry 600,000 lbs. without injury.

The cooling coils are placed within the bearing housing beneath the surface of the oil, and are of such length, number and size as will keep the temperature of the oil within the bearing housing under 45 deg. C., when supplied with water at 25 deg. C., under all conditions of normal operation. The bearings are capable of operating at a max. runaway speed of the unit, not exceeding 111.2 revolutions per minute of the shaft, for the space of one hour, and the temperature of the oil not exceeding 55 deg. C. The bearings are also capable of starting from rest and stopping as often as may be required by

service conditions, and are capable of operating at a speed of 10 r.p.m. for a space of one hour, without injurious heating of oil or bearings.

Bearings are designed to suffer no injury due to interruptions of water circulation for space of one-half hour under otherwise normal conditions, or for a space of 20 minutes not exceeding 50 per cent. above normal speed.

The general construction of these bearings is such as will allow the bearing and all its parts to be removed from the bearing housing without disturbing the generator or waterwheel, except supporting the turbine shaft and generator by independent means provided, and the removing of the thrust block keyed to the top of the shaft.

These bearings are the first ones of this size to be equipped with water cooling coils for circulation of cooling water instead of using oil circulation.

Gibbs Thrust Bearing.

Mr. Eugene U. Gibbs, of S. Morgan Smith Co., York, Pa., has recently developed a type of thrust bearing of simple design. A description of this bearing will be found in the following article, prepared by Mr. Gibbs:

With the advent of the hydraulic turbine, the displacement of the old overshot and breast wheels was very quickly made, when the advantages of the turbine became apparent and accepted. The Fourneyron turbine, of French origin, was first installed on a vertical shaft and supported by a thrust bearing or step, which was copied by the first turbine builders on this continent.

This step, or thrust bearing, was first made of hard wood (maple or oak) on which fitted a concave step shoe. In some cases this shoe was made of cast iron as a separate casting, and in others the shaft swelled on the end and the concave was turned in the end of the shaft. The thrust step in all cases, being under the wheel and in the tail water, was lubricated by the water.

In the early development of the turbine on this continent, all the builders adopted this type of thrust step or bearing; and as the power and speed of these early turbines were very low as compared with those of to-day, the thrust to be taken care of was comparatively small, and there was no difficulty with these bearings unless the water in which they operated contained a considerable amount of sand or grit.

The advent of lignum-vitæ was also found to be an improvement over the native hard woods, and has been universally used for this work. In a few isolated places, manufacturers endeavored to use metallic thrust bearings and were partially successful, but these were plain ring types and had to be very carefully made; for this reason, they did not come into general use. One engineer made a thrust bearing in which he made the supporting ring of glass, but it was found that at varying temperatures the glass faces did not expand

and contract evenly, and this bearing had to be abandoned on this account.

With the advent of the horizontal shaft turbine in the seventies, lignum-vitæ thrust steps were used to a great extent; but in a few years, owing to the possibility of using the marine type, or collar, thrust bearing, the lignum-vitæ thrust bearing for horizontal shaft turbines was soon replaced by the marine type, which was generally a part of one of the bearings supporting the shaft.

Sometimes these collar bearings had four collars, one on each end of the bearing and two between, and sometimes they only had two collars, one on each end of the bearing. They were lubricated by means of oil-rings as in the ordinary ring-oiling bearing. These bearings operated very well on a horizontal shaft when there were two turbines on the shaft so placed that the thrust was practically balanced and the thrust bearing had very little work to do.

When single-runner units were used, the collar thrust bearing had to be very carefully made, with various refinements as to oil feeding and adjustments, so that until within the last ten years it was impossible to sell them, owing to their high cost. However, the purchasing public had learned that the thrust bearing was as important as the turbine itself, and consequently saw the responsibilities of the thrust bearing and were willing to pay for a reliable device to take care of the end thrust.

The development of the hydraulic turbine in this country in the last ten years has been phenomenal. The tendency has been toward increased power and speed with increased efficiency. These have all been brought about by careful study of the application of scientific principles to the design and construction of these machines; and in the development, it was demonstrated that the single runner, vertical shaft turbine offered the best solution for high efficiency when installed in a setting properly designed and constructed.

The main difficulty to overcome was the thrust, especially when the turbine was to be direct connected to an electrical generator. As the capacity of the units was increased, the initial cost of the development per horse power decreased; consequently it soon became apparent to engineers that when conditions would allow, it would be the most economical to install the largest units possible. Under low heads this meant the absolute use of a single runner. This type of setting, with direct connected turbine, was recommended several years before it was adopted. The reason for the delay was the thrust bearing. Ball thrust bearings were tried, as well as roller thrust bearings, but were not satisfactory.

The oil pressure thrust bearing now made its appearance, and consisted of a stationary and a revolving ring, the revolving ring being above the stationary one. Oil was pumped between the rings under pressure and so separated them that when the turbine operated, it was supported on a film of high pressure oil.

But should the pressure fail in the oil supply, the rings would come together and the bearing would immediately be out of service, thereby making it necessary to replace the rings, which was an expensive operation.

It was very evident that a new bearing would have to be developed which would operate without external high pressure,—one practically placed in an oil bath. After several years of experimenting along these lines, the "Gibbs Thrust Bearing" was developed in 1911 and has given results beyond the most sanguine expectations. It consists of three principal elements; namely, a rotor ring, a stator ring and a levelling ring, enclosed in a casing and submerged in oil. It operates on the principle of the wedge, in the following manner:—

The stationary ring or stator has (depending on the size of the ring) four or more radial grooves across the bearing surface dividing it into a corresponding number of segmental sectors. Each sector face has a definite portion flat, and the remaining part of the sector has a gradual taper or bevel to the radial grooves. The circumferential width of the face and the depth of the taper face depends on the unit pressure on the bearing face and the speed of the rotor.

The stator ring, for low and medium pressures up to 300 pounds per square inch, is made of close grain cast iron, and is generally made in one piece, except in some cases where it is necessary to make it in halves so that it can be removed without disturbing the shaft or other parts attached to the shaft.

The bottom face of this ring is made spherical to fit the spherical seat of the levelling ring, and is connected to the levelling ring by means of a dowel pin, so as to allow the stator ring to have a limited amount of adjustment.

The revolving ring, or rotor, is made of cast iron, on to which is placed a soft metal face (babbitt), and is perfectly flat. When the rings are placed in normal position (the rotor ring on the stator ring) there will be a series of flat faces, with alternating wedge surfaces, which, when the bearing is at rest, are filled with oil.

When the rotor ring is rotated, it pulls in the oil, by adhesion, from the radial groove, up the wedge surface. It also carries the oil across the flat surface of the stator ring. The rotor ring in drawing the oil up the wedge surface, develops automatically a pressure between the rotor and stator rings that equals the total load on the bearing.

No Critical Speed. The levelling ring has its upper face spherical, to fit the spherical face of the stator ring, in order to allow for a small amount of alignment, so that the rotor ring will rest properly on the stator ring. The levelling ring is also securely fastened to the casing in which the bearing is placed.

The casing is made of cast iron, of such design and capacity that for low unit pressures, or not exceeding 150 pounds per square inch, auxiliary devices for cooling the oil are not required; but when

unit pressures are higher than this, cooling coils are placed in the casing, or the oil circulated through an external cooling system by means of a small pump.

Owing to the fixed oil film, these bearings have no critical speed at which point the babbitt will wipe off. They can be run slowly as desired without wiping the babbitt. Peripheral speeds up to 5,000 feet per minute have been obtained without any detrimental effect whatever on the bearing. For the most efficient service, an average unit pressure of 150 to 300 pounds per square inch can be used without deteriorating the oil.

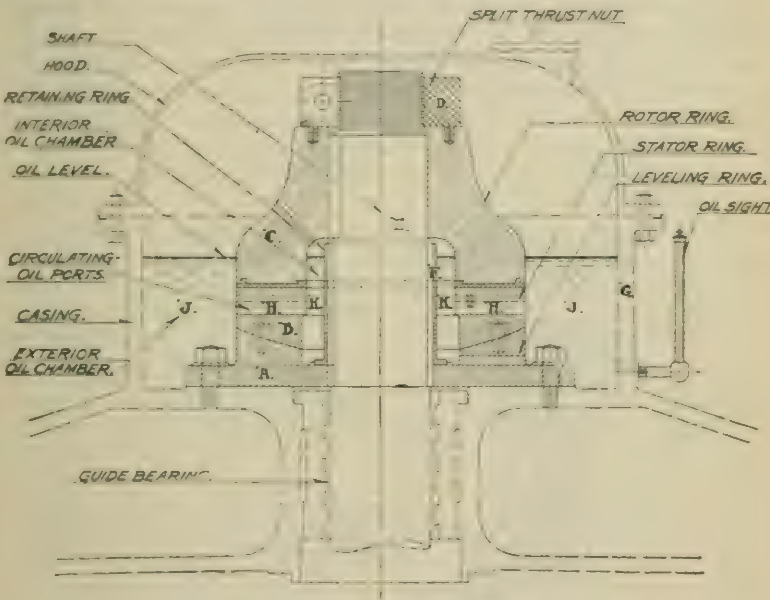


Fig. 4 Section Through Vertical Thrust Bearing.

The principal advantages of the "Gibbs Thrust Bearing" are simplicity, minimum number of parts, fixed oil film and absolute distribution of the load over the bearing surfaces.

Vertical Shaft Bearing. The accompanying illustration (Fig. 4) shows a bearing for a vertical shaft. Similar construction is used for horizontal shaft installations. "A" is a levelling ring bolted to the base of casing "G." The top face of the levelling ring is spherical, to fit the spherical face on the bottom of the stator ring "B." The top face of the stator ring in this particular bearing has six radial grooves and six wedge faces. The ports "H" in this ring allow the oil from the outer chamber "J" to pass into the inner chamber "K" formed by

the retaining ring "F" and the inside of the stator and rotor rings "B" and "C."

The circulation of the oil is toward the shaft "E" from the outside chamber "J" to the chamber "K", and then outward through the radial grooves in the top face of the stator ring "B."

The rotor ring or step "C" has a sliding fit on the shaft "E" and is held by a feather key. The bottom face of the rotor ring "C" is of genuine babbitt metal and runs on the top face of the stator ring "B." The nut "D" is used for adjusting the shaft to take up any deflection that may arise in the support or foundation of the machine.

When the average pressure per square inch exceeds 200 pounds, the oil in chamber "J" is circulated through outside cooling coils by means of a low pressure pump. With average pressure below 200 pounds per square inch, cooling coils can be placed in chamber "J"

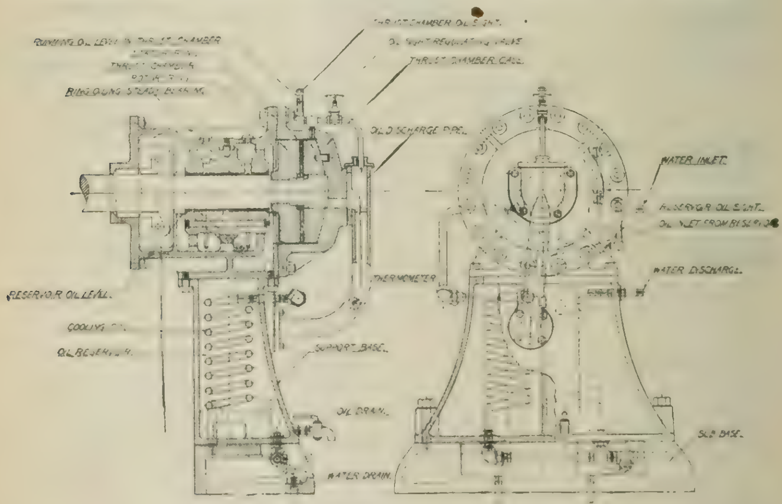


Fig. 5—Gibbs Bearing on Horizontal Shaft

and no exterior circulation of the oil is required; the circulation of the oil within the bearing itself being sufficient.

Horizontal Shaft Bearing. The horizontal shaft bearing consists of two separate bearings, namely, a journal bearing and a thrust bearing.

The journal bearing is used as a steady bearing to support the shaft and maintain its proper alignment. It is of the standard ring oiling type with removable shells in an outer casing. The casing is supported by a hollow base which is filled with oil. Coils, through which water circulates, are placed in the hollow base for cooling the oil after it passes through the thrust bearing.

The thrust bearing proper consists of two principal elements, namely, a rotor ring and a stator ring. The rotor is a cast iron ring keyed to the shaft, and rests against a shoulder on the shaft so that it cannot move endwise along the shaft. It has a babbitt metal face.

The stator is a cast iron ring, and the wearing surface consists of four to twelve sectors, depending on the diameter of the ring, produced by as many radical grooves across the bearing face.

Each segmental face is part flat and part tapered or inclined like a wedge, so that when the rotor is revolving on the stator, in oil, it draws or forces the oil across the inclined surface and consequently builds up a pressure between the rotor and stator; this pressure being in equilibrium with the load on the rotor. The back face of the stator is spherical and fits into the spherical seat of the case head. This allows for a small alignment with the rotor. The stator is prevented from rotating by means of a dowel pin in the case head.

The thrust bearing is lubricated automatically by the rotor, which is partly submerged in oil, as the oil is a little below the bottom of the shaft.

The rotor and stator rings are enclosed in a casing or thrust chamber, which is connected by proper opening to the oil chamber under the journal or steady bearing, to which the oil passes from the reservoir or the tank beneath.

When the rotor revolves, owing to its being partly submerged, it carries up oil with it and fills the thrust chamber surrounding the thrust rings. The only exit for the oil to escape is through the radial grooves in the stator to the centre of the stator, where it discharges into the discharge pipe which carries it back to the oil tank below, completing the circulation. The oil, in passing through the radial grooves in the stator, passes across the bearing faces, consequently the bearing is continually flooded with oil. There is also tapped into the top of the thrust chamber a small pipe in which is placed an oil sight gauge and a small discharge pipe. This enables one to see when the bearing is properly supplied with oil, and the small discharge pipe is used to carry off the excess oil so that it will not flow or spill out of the top of the oil sight. This connection varies in design, depending upon conditions.

There are over one hundred "Gibbs Thrust Bearings" in operation on horizontal and vertical shafts, operating under most trying conditions. They are installed on centrifugal pumps, hydraulic turbines electric generators, bevel mortise gears, and even Ford automobiles. Propositions are now under consideration to install them on steam turbines and steamships. On account of the simplicity of the bearing its cost is moderate.

This bearing can be used where there is a thrust on a revolving shaft, no matter what the load or speed. Horizonal bearings carrying loads as high as 100,000 pounds, and vertical bearings carrying

loads as high as 220,000 pounds, have been in continuous operation for more than two years.

Kingsbury Thrust Bearing.

The Kingsbury thrust bearing has already been described to a great extent in many engineering periodicals and shall not again be treated in this report. It may be of interest, however, to the members to know that this type of bearing has been adopted by the Hydro-Electric Power Commission of Ontario for the Westinghouse generators on the Queenston Development. They are designed to carry a load of 900,000 lbs. at 187½ r.p.m.

Governors.

No radical departure from standard designs of governors, mechanical or hydraulic, have taken place recently. The tendency has been in the past to specify quick acting governors in order to maintain a constant voltage. This tendency may lead to serious troubles, particularly where the turbines are connected to long penstocks, which are not protected by relief valves or surge tanks.

Designers are aware of this danger, and considerable attention is now paid to this problem.

Troubles encountered in governor systems, such as corrosion of pipe lines and governor parts, where water is used as operating fluid, are being met by the introduction of soluble oil, barium hydrate and potassium bichromate into the operating fluid.

There still seems to be a difference of opinion among designers as to the advisability of using individual governor systems or to have all governors receive the operating fluid from a central pumping system. The latter system is, as a rule, the cheapest, and when the necessary care is taken in laying out pumps, pipe lines, etc., very satisfactory from an operating point of view.

A noticeable improvement has taken place in recent designs of water turbines with regard to accessibility, thorough lubrication and easy cleaning of turbine parts. One of the important features of the single runner vertical unit is the easy removal of gate rigging mechanism for inspection as well as the easy adjustment of guide vanes.

Ice Troubles.

Recent papers on the problem of combating ice may be mentioned: Mr. R. M. Wilson's paper, read before the Engineering Institute of Canada (see journal of Engineering Institute of Canada, Vol. II., No. 5) and Mr. Groat's paper, read before the A.S.C.E. (see Transactions, Vol. LXXXII.)

Test Code Hydraulic Power Plants.

The committee representing the National Electric Light Association, the American Society of Civil Engineers and the American Insti-

tute of Electrical Engineers, appointed to confer with the American Society of Mechanical Engineers to draft a hydraulic power plant test code, has had several meetings during the past year, and it is expected that the code will be in final form during the year.

Your committee is in receipt of statements from the following manufacturers, covering developments during the past year:

Wm. Cramp & Sons, Ship & Engine Building Co., Philadelphia: During the year 1916 there was considerable activity in the hydro-electric field, and during this time our company secured the contracts for turbines aggregating 192,200 horsepower. All of these turbines were of the vertical shaft, single runner type. Of the above aggregate horsepower, 62,200 horsepower represented units designed for comparatively low heads, having the casings and draft tubes moulded in the concrete substructure of the power house. The remainder, aggregating 130,000 horsepower, represents turbines designed for intermediate and high heads and, therefore, having casings made of either cast iron or cast steel.

During the year 1917, due to war conditions, the development of hydro-electric plants decreased very materially. During the year 1918, however, there was considerably more activity, and last year almost equalled the horsepower constructed in 1916.

About one-fourth of the units contracted for during the year 1918 by our company were for extensions to existing plants, and the remaining units were for new installations. There was a marked tendency during the past year for the installation of high-powered units, the average size units being 17,600 horsepower. The 37,500 horsepower turbines now under construction for the Niagara Falls Power Company, when completed, will be the most powerful turbines in the world.

There was but little activity in low head installations, on the turbines contracted for by our company during 1918 the designed head ranged from 130′ to 475′. These units are all provided with cast iron or cast steel volute casings and, with one exception, are of the vertical shaft, single runner type. Inquiries received, however, indicate that the low or medium head installations will be developed to a large extent in the near future. The vertical shaft, single runner unit, both for low and high heads, has been so thoroughly established in modern practice, that except in the case of extensions to existing stations already built for horizontal settings, the former type is universally adopted.

The record efficiency of 93.7 obtained in 1912 from the vertical shaft turbines in the plant of the Appalachian Power Company has not as yet been beaten or equalled. A record, however, for horizontal shaft units was established last year when an efficiency of 92,3 was obtained on a unit built for the Great Northern Paper Company.

A problem now receiving a great deal of study and experimentation by manufacturers is the proper design of draft tubes. This is

of special interest in connection with low head units where high specific speed runners are used, due to the fact that the velocity of discharge from the runner is high, so that the energy to be regained in the draft tube is a much greater per cent. than in the case of high head units where low specific speed runners are used.

The Wellman-Seaver-Morgan Company: At the present time we have a tremendous amount of inquiries and outstanding proposals, which we expect to be settled this spring and summer. Last year was very quiet in hydro-electric work, and gave us an opportunity to carry on development work.

I may say that it has been generally realized by hydraulic turbine engineers, that we have nearly reached the limit on the efficiencies of runners as regards the runner itself. 92% and 93% is about as high as can be expected. In order to show still further improvements we are looking into the design of all passageways from the head gate to the tail race. The spiral casings, gates and draft tubes should receive special attention for each particular design of runner; this is the only way to obtain the maximum efficiency.

Recently we have tested a draft tube which gave 1½%. higher efficiency, and more power than the generally accepted design of concrete draft tube. We expect to test out further designs within the next few months, along other lines.

For low head turbines in open flume settings we have developed an exceptionally high speed runner showing a specific speed of 170, as against about 100, which was considered the highest obtainable.

A great deal of study has been made of low capacity remote control plants, by both turbine and generator manufacturers. There is bound to be a great many developments of this nature. One centrally located plant of fairly large size can be used as the master station, and several other low head plants within a radius of 15 or 20 miles can be operated from this plant without any attendants whatever except a man to drop around occasionally. This is nearly a necessary condition in order to make a plant of 100 to 500 h.p. a paying proposition. In order to operate these plants without attendants, it is necessary to design all machinery accordingly and make it as simple as possible. Induction generators are used in order to get around commutator troubles, and because they can easily be thrown on the line. The electrically operated gate mechanism is used instead of a governor, and gives surprisingly good results. In case of a large load thrown off due to lightning troubles, the unit is designed so that it is safe under runaway speed. If this should happen a man is sent to the plant to shut down the unit by hand.

In all new plants, single vertical turbines are used without exception, due to the higher efficiencies obtained. With a large unit, direct connected exciters on top of the generators, and central oil system for the governors, have become standard practice. We also note the increase in the number of out-door transformer stations and

the more general use of Taintor Gates, both for head gates and on the dam. Several very successful installations of automatic gates, or roller dams, have been put in recently, and in one case the success of the whole proposition depended on this one feature.

The largest proposition being developed at the present time is the Niagara Development, on the Canadian side, for the Hydro-Electric Commission of Ontario. We have just been awarded the contract for the first two units, and the Canadian-Westinghouse Company the generators. Each turbine will develop 52,500 h.p. at point of maximum efficiency, and about 60,000 h.p. at full gate. The water will be taken from above the upper rapids, through the Welland River, which will be dredged out, and thence through a canal 14 miles long by 48 feet wide and 35 feet deep, to the power house located down near Queenston. Nearly the total drop between Lake Erie and Ontario will be obtained. The net head on the turbines will be 305 feet, and the speed 187½ r.p.m. The turbines will be single vertical with cast steel spiral casing. Ultimately it is intended to develop about one million horsepower in this plant.

The largest development at Muscle Shoals is being pushed by the Government, and will have about 15 units of 30,000 h.p. each under 96 foot head. There are also about five large developments in California to be settled this spring, and three in Washington. The interesting feature out there will be the use of reaction turbines of approximately 20,000 h.p., under 800 feet head.

Wisconsin, New York and Maine are next in line with the greatest number of active propositions. The U.S. Reclamation Service, through Secretary Lanes' endeavors, will open up a great many hydro-electric developments in the West this year.

Last year we shipped two turbines to Canada—one a 5,000 h.p. Twin Horizontal Turbine for the Healy Falls plant, and the other a 2,300 h.p. Twin Horizontal Spiral Casing Turbine for the Big Chute plant of the Hydro-Electric Commission. These were additions to old plants, which explains the use of horizontal turbines.

In all, we are very optimistic of the future in hydro-electric work, and expect 1919 and 1920 to be record years.

William Hamilton Company, Limited.—Referring to your recent letter regarding our activities and progress in turbine construction during the past three or four years, we beg to say that we have been confining our attention principally to the lower head developments, ranging from 100 ft. down.

Water power development throughout Canada during the war has been very much restricted. However, we are looking forward to a period of activity and much greater development as soon as conditions have adjusted and righted themselves. We would say that the most notable feature of recent turbine development has been the high speed, high efficiency runner used for single runner, low head,

direct connected units; this type of installation coming more and more into general use.

Most of the installations which we have furnished during the last few years have been for the smaller power low head developments. At the present time we are installing two 62″ Type "J" single runner vertical units for Messrs. Frasers, Limited, Edmundston, N.B., H. S. Ferguson, New York, Consulting Engineer; one twin runner 37½″ horizontal centre discharge for open flume setting for the Canadian Consolidated Rubber Company, St. Jerome, P.Q., Messrs. T. Pringle & Sons, Limited, Consulting Engineers, and we have in process of construction in our works four 51″ type "Z" single runner vertical units for the Montreal Cottons, Limited, Valleyfield, P.Q., R. S. Kelsch, Consulting Engineer.

Regarding recent developments in governors, we have been using principally the Woodward Oil Pressure Governor. We wrote them for information as to recent developments and improvements in governors, and the following is an extract from their letter:

"During the past three or four years we have not made any particular changes in the design of our water wheel governor. The horizontal and vertical types of oil pressure governors were developed just previous to that and seemed to meet the conditions so perfectly that no radical changes seemed advisable. The demand for these types has increased very greatly during the period stated, which we attribute to the trade becoming familiar with their advantages. Slight changes are constantly being made, but these refer more to securing increased accuracy and convenience of operation.

"During the period stated the most radical change we have made is the adoption and perfection of the rotary pumping unit for use in connection with the oil pressure governor. This accessory has been developed and simplified until it appears to be free from all faults, and contributes very largely to the satisfactory service given by the governor."

Boving Hydraulic & Engineering Company, Limited.—"We have not done anything very spectacular, and so far we have not turned out any really large wheels.

"We have supplied three 2,250 b.h.p., 257 r.p.m. Twin Horizontal Turbines for the City of Orillia, working under 45′ head; one 2,000 b.h.p., 514 r.p.m. single horizontal spiral turbine for the Pembroke Electric Light, working under 124′ head; one 1,700 b.h.p., Twin Horizontal Turbine for the City of Sherbrooke, working under 30′ head, and two similar 1,450 b.h.p. wheels for the same people; two 3,500 b.h.p., Single Vertical Turbines for the Southern Canada Power Company, working under 32′ head when running at a speed of 100 r.p.m.

"We are at present working on a Quadruplex Horizontal Turbine for the Ottawa & Hull Power & Manufacturing Company, that will

develop 7,500 b.h.p. under 32′ head, and about 10,000 b.h.p. under a maximum head when running at 120 r.p.m."

In conclusion, your committee is pleased to state that as far as it is possible to judge interviews and correspondence we have had with the power companies representatives as well as manufacturers, the future for hydro-electric power enterprises in Canada are good, and as soon as the general unrest in the country is settled undoubtedly a number of new developments will be started.

Respectfully submitted,

A. J. MacDOUGALL.
ALEX. WILSON.
S. SVENNINGSON, Chairman.

A copy of the report of the Sub-Committee on Generators of the N.E.L.A., with reference to fires in turbo generators, was also included in the above report. This is printed in the 1919 N.E.L.A. proceedings, page 290.

The President: Mr. Beaumont, who has been kind enough to read this particularly interesting paper, will please formally move the adoption of the Report.

Mr. Beaumont: I move the adoption of the Report.

Mr. Anderson: I take great pleasure in seconding it.

The President: Of course, although the word discussion is used, it naturally involves the putting of any question if anybody wishes to get any further light on the report. In this case the author of the report is not here, but no doubt Mr. Beaumont will be kind enough to give us any information he can.

Well, if there is no discussion, it has been moved and seconded that this Report be adopted. (Carried.)

The next item upon the programme is the Report of the Committee on Electrical Apparatus, a paper which will be read, in the absence of Mr. Neild, by Mr. Schwegler.

REPORT OF ELECTRICAL APPARATUS COMMITTEE.

J. F. Neild, Chairman.

Mr. Chairman and fellow Members:

Your Committee on Electrical Apparatus are taking the liberty of departing from the usual custom in their report, and are presenting for your information and discussion the general trend of Electric practice rather than merely a catalogue of new apparatus.

We have been in very close touch with meetings of the National Electric Light Sub-Committees, and in conjunction with them are dwelling upon the more practical operating conditions than heretofore.

We realize the great value of co-operative study, and are bringing before you many points that have been discussed in various subcommittees of the N.E.L.A., feeling in this way that the Canadian

Electrical Association will take a larger part in the work of advancing the study of practical problems of our art, and we would also add that the opinion of the Canadian Electrical Association has been requested through your committee representative on many of these points.

Turbo-Generators.

One of the side issues brought into existence by the sustained overloads carried during the war service is the question of fires, their origin and the best means of handling them, and in view of this a questionnaire was circulated by the sub-committee of the N.E.L.A. early this year, giving the following results:

Some 30 companies reported 81 fires in the past five years, 21 fires equally divided between 60 and 25 cycle units were specifically described occurring in units ranging from 3,300 to 35,000 kw. and from 2,300 to 13,200 volts.

About an equal number of fires appeared to have started within the insulation and external to the insulation. The greater proportion of fires external to the insulation seems to have occurred on 3 phase systems operating without a grounded neutral. Other causes are many, principally short circuits and grounds, with the remainder from mechanical causes, eddy currents, moisture, etc.

The consensus of opinion is that more frequent inspection and cleaning of the generators is very desirable and have a direct bearing on the liability to fires from sources external to the windings. Too many companies appear to trust the air washing devices for this work, but even with the best possible apparatus, air and grease creep in, fluff and dirt accumulate and conditions for potential fires exist. Good practice, theerfore, would indicate periodical cleaning, and we would invite a full discussion on this point.

The grounding of the neutral of 3 phase systems solidly or through resistance is rapidly becoming standard practice on both 25 and 60 cycle throughout the country.

Twenty-one of the thirty companies replying favor this method of operation; five operating with solid ground system preferring to operate through resistance; three companies opposed the grounding of the neutral. The consensus of opinion seems to be that grounding is very desirable, and in addition to other advantages has a considerable effect in the reduction of generator fires occurring external to the insulation of the conductors.

It is also rapidly becoming standard practice, particularly on large units, for the manufacturer to bring out both ends of each phase winding to the generator terminal board so as to permit the installation of current transformers between the terminals of phase windings and the neutral of the coils. The current transformers can be connected differentially with respect to the instrument current transformers in the leads between main oil switch and generator, so that in the event of a fault in the generator or its leads the

balanced relay will immediately open the main oil switch, the neutral switch if closed, and, after slight delay, the field switch.

Twenty-four of the thirty companies reporting approve the installation of balanced relay protection, and have adopted it as standard practice on all new generator installations and on older generators where the expense involved is not too great.

The modern type of turbo-generator is usually completely enclosed, and the blower action of the ventilation is such that fires are apt to become serious and very difficult to extinguish. As in the case of most fires the time element is the main factor in controlling it, it is especially important to apply the extinguishing medium as promptly as possible and as close to the seat of trouble as can be done without permanent injury.

This leads to the question of ways and means of fire fighting. Water, steam and carbon tetra-chloride are looked upon with favor, the standard ways of applying being to pipe these mediums up to the end bells and provide a stand-by service.

Sub-Stations.

The outdoor type of sub-station is rapidly being adopted for both industrial and distributing purposes. Some companies are using self-contained out-door metering outfits and report practically no trouble with them. Other companies are using small structures for switches and meters, while others are using all weather-proof apparatus.

The use of single-phase transformers for three phase banks is still general, but in many cases, particularly in limited quarters, the 3 phase transformer is becoming more popular.

The general practice appears to be to install transformers of just sufficient capacity to carry the load and use water cooling and spraying for overloads.

For protection of customers' sub-station the practice varies from over-load relays on the main oil switch and fuses in each transformer to the practice of one large company in the Southern States which treats transformers for 11,000 volts and upwards as part of the line, and provides no protection. We understand they think they are justified by the results obtained.

The automatic sub-station for direct current is growing in popularity. There are at present on d.c. railway service seven sub-stations of 1,000 kw. or over, and 49 sub-stations between 300 kw. and 600 kw. All have been operating automatically or semi-automatically for some time, but apparently only one company operates automatic sub-stations in a 3 wire d.c. system. The d.c. automatic sub-station is here to stay, and engineers would do well to investigate it thoroughly as an economical proposition. We believe we are correct in saying that the manufacturers are prepared to produce reliable automatic apparatus when it is called for.

Automatic or semi-automatic a.c. sub-stations are in continuous operation. Some being straight outdoor type and some part outdoor with switching and metering buildings. These sub-stations usually consist of step down transformers with outdoor type potential regulators. In some cases automatic reclosing oil circuit breakers are used. These will open and close a circuit several times in a few seconds. After the third time of opening the circuit remains open until re-set by hand. Apparatus in automatic sub-stations should be more liberally rated than is customary, and should be of the most rugged construction. It is particularly desirable that the members should bring out in their discussion their experiences with outdoor sub-stations under the climatic conditions such as we experience in Canada, and we believe this will be a valuable contribution of knowledge on the subject and we have been requested to ascertain the effect of our climatic conditions on all apparatus operating in oil.

As sub-station apparatus, the rotary converter with a capacity of about 4,000 kw. appears to be about the upper limit in this class of machine. With the extension of the use of 60 cycle as a system frequency the 60 cycle rotary has come more into prominence, although at times on railway service flashing is troublesome. The use of flash guards, arc cooling devices and high speed circuit breakers is expected to bring them up on a par with 25 cycle machines.

Remote control, electrically operated d.c. circuit breakers are generally used on large rotary converters, and in many cases remote control starting switches are also used.

For ventilation of large rotary converters most companies depend on the ventilation of the sub-station room; only one company operating a large number of rotaries in basement sub-stations uses a combined pressure and exhaust air system, and has considered partial housing of the machine for artificial ventilation. Also one company brings air from the air chamber for its transformers through some spare ducts and, by means of baffles, directs the air around the machine. Blowers giving approximately 1½ ozs. pressure will usually have a capacity for both purposes.

In summing up the rotary converter practice we find that in large inter-connected a.c. transmission systems some companies using relatively small sized converting units prefer motor generator sets, but companies with large converting equipment of 200 kw. and above prefer rotaries on account of the efficiency and convenience over large range of loading.

The general policy of operating all banks of transformers and distribution feeders on one bus with an auxiliary bus provided is maintained. The capacities so connected are running considerably higher than 10,000 kv.a., and this brings up the question of the rupturing capacities of oil switches; in order to avoid considerable expense in changing over apparatus, as well as possible switch destruc-

tion, the use of reactors would seem desirable. Considerable difficulty exists in the determination of what constitutes the rupturing capacity of an oil switch; also the time element which should elapse before closing and re-opening the switch, as most oil switches are rated on a two minute basis. This would seem to eliminate the use of automatic re-closing devices, and your committee feel a discussion on the desirability of being able to close an oil switch, which has opened under short circuit conditions, almost immediately and to expect the switch to still break its capacity and not sacrifice itself in doing so.

In view of the difficulties confronting the manufacturers in obtaining sufficient concentration of power for the testing of larger breakers, and in view of the value which could be derived from evidence as to the successful or non-successful functioning of breakers under actual short circuits, it is recommended that the operating companies make reports of such occurrences of importance to the manufacturers of the breaker, giving such data as will enable him to determine what service the breaker performed. Of such importance is this question that your committee would suggest co-operating with the switchboard sub-committee of the N.E.L.A. in view of using a standard report form which that sub-committee contemplates devising. The chairman of the committee by this co-operation should be in a position to advise the member reporting if similar troubles or successful results have been experienced with breakers of the same type.

Your committee at this point feel it desirable to call attention to the neglect which is usually the lot of the air break switch, and would point out the danger of abnormal temperatures which are liable to be caused by oxidization creating bad contacts. The high tension air break disconnecting switch is particularly liable to this neglect, being usually placed out of ordinary reach and left to take care of itself year after year. We feel that these switches will repay the attention given them.

Your committee feel that in view of the work in connection with the standardization of constant potential transformers and the lead markings for the same that has been done by the general conference committee on technical subjects representing the American Institute of Electrical Engineers, the National Electric Light Association, the Electric Power Club and the Association of Edison Illuminating Companies, and in view of the fact that these standards are being accepted by the manufacturers, that they would recommend the tentative adoption of this report as a basis for the establishing of these standards for Canada, or the adoption of the report in toto if found desirable.

Your committee feel it is the duty of this Association to assist in the establishment of international standards if they can be adopted by our country without sacrificing our interests, and append herewith the report of the standards as revised in 1919 for your approval.

Report on Transformer Standards is printed in 1919 N.E.L.A. proceedings, page 390.

Respectfully sumbitted,

W. H. McINTYRE.
C. J. PORTER.
M. D. SCHWEGLER.
J. S. H. WUERTELE.
J. F. NEILD, Chairman.

Mr. Schwegler: I move the formal adoption of this Report.

Mr. McIntyre: I second that.

The President: You will notice, as I did, that discussion was specifically invited as to three points. One that I noted was the question of periodical cleaning for the purpose of obviating fires and the other was method of fire fighting, and the third had to do with the subject of dealing with certain machinery under climatic conditions of our own country.

Mr. Beaumont: In connection with the operation of the automatic sub-stations, I would like to ask a question. Though not engaged with sub-stations, we have a number of small plants that we have acquired, containing one or two water wheels; we have one wheel with a generator of about 300 kw. capacity which we propose to operate semi-automatically before long. Should we have trouble in the plant that plant will be shut down until such time as an attendant can get to it, and I wonder if any of our members could give me any information as to whether they have had any experience along these lines. These plants when taken over might as well be made some use of, but to keep three operators looking after a small plant all the time is a large expense which is hardly justifiable, while semi-automatic operation will certainly make them earn a little money.

Secretary Volkmann: One question that is brought out by Mr. Neild's paper is that of cleaning of apparatus. In the Toronto Railway Co. we have about 50 air blast transformers, 375 kw., 12,000 volt to 410 volt secondary. We used to burn out about two of these transformers a year. In one station we have 15 transformers, all connected to a common air pit. If one transformer short circuits it is almost impossible to shut down the station in order to get that transformer out of service, with the result that before you get a chance to put out the fire the whole transformer is practically destroyed. One thing that was done to overcome this trouble was to make a canvas hood which we could slip down over the transformer, in order to cut off part of the air to it. We found, however, that by systematic cleaning during the last two years, we have not had a single failure. Some of these have been in service since 1907. This certainly shows that with just a little systematic care of apparatus more than amply repays you in the elimination of trouble.

This is also true of our thousand k.w. rotary converters. It used to be necessary to sandpaper the commutators of two or three machines a week in order to keep the machines in operation. The rated load is 1,675 amperes, and it was never considered possible to carry over 2,200, and if this was exceeded it took two or three hours after going through a peak load period to get the machine in condition for the next peak load. The commutators have now been undercut, and equipped with new brush holders and brushes. We used in the past from 75 to 100 new brushes a week to keep the machines in operation, while in the last four years I do not believe we have used 500 brushes in the whole system. Furthermore the operators now do not hesitate to load up the machines to 2,900 or 3,000 amps., which is about 75 overload or what the machines should really carry.

Mr. Beaumont: I would like to add a word to what Mr. Volkmann has said regarding inspection. Inspection as a word does not mean much; it all depends on how the work is carried out; with some men, if it is left to them and they are not checked up, inspection just means looking at switch and perhaps trying it and leaving it. We find that the only way to make certain that you have absolutely reliable switches is to take the current off the piece of apparatus or switch, clean contacts, inspect all mechanical details and practically almost in a small sense rebuild the equipment. That, of course, sometimes means a small shut down, and in important service means duplicate equipment, but it is about the only way you can have reliable and continuous operation. Our Mr. Anderson here has done a lot for us in that way on outlying systems and keeping the men up to that work.

Secretary Volkmann: Possibly Mr. Anderson would like to say a few words on that.

Mr. Anderson: I cannot add very much to that except that we have made a rule of at least inspecting all oil switches twice a year, and that means taking down the oil receptacle and seeing that they are properly cleaned, and blowing out any dust or dirt that might have accumulated on the top, and seeing that the terminals are perfectly clean.

Mr. Gregory: I would like to ask for some information regarding the grounding of a neutral through a resistance. During the last year we had occasion to change a line from 13,000 to 25,000 volts by changing the transformer connections from Delta to Star. It was our original intention to ground the neutral, through resistance, but in designing the resistance we ran into difficulties both in selecting the resistance wire and method of mounting. I would like information on the kind of resistances used on 25,000 volt lines or lines of higher voltage on which the neutral is grounded through a resistance.

The President: If there are any questions asked by any of the members, I do trust that if anyone can give some information, he will not hesitate for a moment. Last year there were some questions asked by a member, and afterwards I think he felt that

his questions had not been answered, and perhaps he felt that they might have been. I do not know whether that was in his mind, but seriously and earnestly I do ask any of you who can give assistance in answering any question put, to do your utmost to help us along.

Mr. Maclachlan: There are one or two points in the report that I would like to emphasize, particularly that in connection with the fighting of fires in generators. I think it was brought out at the N.E.L.A. meeting, to which a similar report was presented, that dry steam was absolutely useless in putting out fires. You must have wet steam or water to put out a fire in a generator. All those using dry steam or superheated steam found great difficulty in putting out fires in generators.

Dealing with the question of carbon tetra-chloride in fighting fires, I would like to warn you all that carbon tetra-chloride, if used in a confined place, will knock out a man; there is danger of a man being allowed to remain in an atmosphere of chlorine, with very serious results.

In connection with using your pyrene extinguishers, just remember that we are advised that almost three per cent. of the filler in your pyrene extinguishers is a deadly poison, and warn your men not to shoot pyrene on each other. Do not start any horseplay with it, or it might have fatal results.

At the present time I happen to be making some experiments with Pyrene and Johns-Manville extinguishers, to find out exactly what is in this mixture. I am advised that it contains a deadly poison.

In connection with inspection work, in carrying out inspection on switches, I point out the necessity of disconnecting switches on each side of your oil switch. Too many oil switches are installed, possibly in your small sub-stations at the present time, without means of disconnecting on both sides of your oil switch. If, due to design, it is impossible to put in disconnecting switches, then a link should be put in the conductor so that you can have a short shut down, cut the link out of service and then put on your service again, so that the man can make his inspection entirely clear of the current.

I have been asked to make an amendment to the formal adoption of the Accident Committee's Report, and to suggest that the part of report dealing with the standards be referred to Mr. Dion so that the matter could be laid before the Canadian Engineering Standards Association.

The President: I do not know whether I quite understand that.

Mr. Maclachlan: The report has been moved and seconded and formally adopted, and the suggestion is—

The President: Would that interfere with the suggestion you make?

Mr. Maclachlan: Just amending or adding to the—

The President: It is not diametrically opposite. The two things are quite consistent, are they not?

Mr. Maclachlan: Yes, quite consistent.

The President: So that the motion then is, that not only that the report be adopted but that a copy of it be transmitted to Mr. Dion as Chairman of the sub-committee of which we have heard this morning, for the purpose of laying it before that sub-committee, is that the idea?

Mr. Maclachlan: Yes.

Mr. Dion: I might say in this connection, although this committee is not at work yet, that it will be necessary to obtain very full information on the subject from all sources, because the committee is not only called upon to suggest standards, but those standards are to be made, if possible, uniform with those they are now working upon in England and those in the United States. The idea being to consolidate all the information and to try to suggest standards which will be uniform throughout these countries. I would like to call upon all the members here who have any suggestions to make, whether on the committee or not—because I think the committee will only comprise a few persons—that they should send them to me, because we cannot have too much information on the subject when we get down to work.

The President: I was wondering if Mr. Kaelin would have anything to say on this matter, which he thinks would be of interest to any other members of the Association?

Mr. Kaelin: I do not think I have anything to say on the last subject, especially about the standardization.

The President: I meant rather with reference to the main matter.

Mr. Kaelin: I thought more about the report by Mr. Svenningson, one point especially which may come up in future and which may be of considerable importance, that is specific speed. The last few years manufacturers have been very conservative in going higher with the specific speed of turbines, because it involved considerable experimentation. But the latest information we have from the Old Country on the subject is that there has been considerable progress made in increasing the specific speed. It is very obvious that by doing so we increase the speed of the turbine and cheapen especially the generator. At the present time, when costs are running up generally, it is very desirable to find some points where we can lessen that cost, and that is by increasing the speed of the generator. We hope that with the low head turbines especially we will be able to increase that speed perhaps 50 . We do not like to increase the speed on the higher head turbines, because there are many difficulties coming up in the design of the turbines, especially in the elimination of corrosion. I think that the higher specific speed is one of the points in which the next improvements will be made in turbines.

The President: Is there any further discussion on the paper which we have just had read?

It has been moved and seconded that the report be adopted, and also that a copy of it be handed to Mr. Dion, Chairman of the sub-

committee of the Canadian Engineering Standards Association, for the purpose of taking it up with the sub-committee. Is it your wish that this amendment which has been added to it be adopted? (Carried.)

The next item on the programme is Report of Committee on Overhead Lines, by Mr. Dion, Chairman of that committee.

OVERHEAD LINES COMMITTEE.

A. A. Dion, Chairman.

There is really no formal report from the Overhead Lines Committee. When I was asked to take the matter up I felt that the subject had been very fully covered already, and I consulted with the other members of the committee, and with some other members of the Association, inviting suggestions as to any special features that we might take up during the year, and the only suggestion that was received was with regard to outdoor sub-stations, and in order to obtain the necessary information a questionnaire was sent out to all member companies. Very few answers were received. In fact answers are so few that they do not at this time justify a report on the subject. I am pleased, however, that the Apparatus Committee has dealt with this matter somewhat. There was a question whether this really belonged to the Apparatus Committee or Overhead Lines Committee. However, I took it up, but, as I said, very few answers were received. These answers may form the subject of a report at some future convention, with added information.

A question was asked by a member company and referred to me by the Secretary, and I included that in the questionnaire—it was with regard to the use of bare wire vs. covered wire in 2,200 volt distribution. This is an old subject. It has already been pretty well threshed out, but I added the question to the questionnaire, and there was only one answer received, and this answer is shortly to the effect—and it agrees with my own view—that while the ordinary insulation we use on 2,200 volts is no real protection, and it might be considered by some as useless, that it is of some use at least in dry weather in city distribution.

I regret that it is not possible to give you a report that would be of service to you, but, as I said, the subject of overhead lines has been pretty well covered up to date, especially by the N.E.L.A.

The President: I do not know whether you have a report to move adoption of.

Mr. Dion: There is no report, sir, just this informal communication.

The President: As that is the formal end of the business we have for this morning, unless there is some discussion on the papers, I would like to make a request of the members of our Managing Committee. The Nominating Committee should really be appointed a

month previous to each annual convention. It has not been possible to do that this year, but generally the Nominating Committee has just been named by the President, and I am not in the least criticizing that, but for my own part I prefer to follow the language of the Constitution, and that says, "With the approval of the Managing Committee," and as I read that language it means that they shall not only approve that he appoint the committee, but that the committee itself shall be approved by the Managing Committee. Assuming, therefore, that my construction is correct, I am going to ask the Managing Committee to be kind enough to meet me, if they will, about ten minutes to 2. The meeting this afternoon is scheduled to begin at 2, and if they will kindly meet me at 10 minutes to 2 I shall be glad to talk to them for a minute or two.

If there is no further discussion on any of the papers I declare the meeting adjourned to meet again at 2 o'clock this afternoon.

On resuming at 2 o'clock.

The President: I would just like to announce that the Nominating Committee has been appointed and consists of Mr. Dion, Mr. Gould, Mr. Woodyatt, Mr. Beaumont and Mr. Schwegler. As to that committee, it is not quite clear to myself or to the Managing Committee that we have the right of nominating a chairman of the committee, but, subject to the wishes of the committee itself—and we have no doubt as to that—we have great pleasure in saying that in our view the best interests will be served if Mr. Dion will kindly act again as chairman of that committee. As to the duties of the committee, Mr. Dion is probably well advised, but we have copies of the Constitution here, and I, of course, am always available if I can be of any service. They need not be prepared to discharge their duties until the afternoon of to-morrow, when the Executive Committee meets.

The first item of business this afternoon is the report of the Committee on Meters, paper to be read by Mr. Turley.

REPORT OF METER COMMITTEE.

E. J. Turley, Chairman.

To the President and Members of the Canadian Electrical Association:

Your committee this year has decided to depart from the established precedent of the Association, and instead of preparing a report of a technical nature, to present the following with a view to opening a discussion.

In view of the fact that the greater part of the revenue of operating companies derived from the sale of electric power depends upon the accuracy of the electric meters, your committee this year has decided to discuss the present commercial methods of recalibrating and Government inspection of meters. The accuracy of calibrating com-

mercial meters depends fundamentally upon the maintenance of accurate standards. At present the standard meters are calibrated from time to time in various isolated laboratories, either maintained by the operating companies themselves or by the universities, and in some cases by the Government laboratories, and the frequency of testing these standard meters rests at the discretion of the individuals in charge of the meter departments of the various operating companies. It is well known that different companies have different equipment for the calibration and standardization of their various instruments, varying more or less in accuracy. We believe it would be very much to the advantage of the company members of the Canadian Electrical Association if, instead of each company maintaining a primary standard laboratory, that arrangements be made whereby more use could be made of the beautifully equipped and very little used Government laboratory at Ottawa, which, we presume, was equipped with surplus revenue from meter inspection, and therefore should be devoted to the benefit of the companies who supplied it. At present it is possible to send instruments there and have them tested, but as so little use is made of it by the public the routine for handling them with dispatch is not given very much attention. At the same time, we feel that this is not the fault of the Government, but that of the companies for not having instituted arrangements whereby more use is made of these facilities. The use of this laboratory by all Canadian companies would not be practical, owing to the extreme distances from Ottawa. However, it might be possible to arrange that Government inspectors, with primary standards which are portable, make periodic visits to the plants of the various companies and check their working standards. In making this suggestion we do not feel that we are asking the Government for anything we are not entitled to, as the understanding has always been that the revenue derived from meter inspection was for the purpose of covering the expenditures in connection with inspection, and as the Government blue book for year ending March 31, 1918, shows a surplus of revenue over expenditures of $35,019.47, a surplus revenue such as this should not only permit of a reduction of rates, but also the establishment of a very complete system of Government checking of secondary standards and cover the expenditure in connection with the checking in the laboratories at Ottawa of any standard meters required at a very much lower rate than at present exists.

It has been brought to our attention that there is a movement on foot by the Hydro-Electric Power Commission of Ontario to delegate the work of testing and sealing meters to the various provinces, thus taking it away from the Canadian Government, and incidentally, we presume, allowing the Hydro to escape from paying a tax, which would be chargeable to competing companies. This, to our minds, would be a serious mistake, and we feel it our duty to object strongly to any effort of this kind, and would suggest that this Association

should go on record to the Government against it, as if the work were delegated to the different provinces the meter manufacturing concerns would be obliged to comply with numerous conflicting requirements, involving more or less unimportant details, and the standards for the different provinces would most likely vary to such an extent that the meter manufacturers would find another reason for increasing the present high cost of integrating meters. At the same time, we feel that a determined effort should be made to have the Dominion Government improve their present system of meter inspection, as at the present time, besides being expensive, inconvenient and unsatisfactory, it offers very little protection either to the companies or the public, and we question if outside of moral effect it has any use whatever.

There is at present being organized in Ottawa a committee on standardization of engineering standards. They are undertaking the standardization of tungsten lamps and machinery and equipment of different kinds, and we believe that they should be petitioned with a view to having them arrange for a committee on the standardization of integrating watt meters, with the view to having dials, connections, etc., made standard with all manufacturing companies.

During the past year there has been considerable discussion with regard to the changing of power circuits from twenty-five cycles to sixty cycles and vice-versa. One of the member companies who has changed from twenty-five to sixty cycles has succeeded, at very small expense, in altering his twenty-five cycle meters to operate at sixty cycles.

Your committee further recommends, in view of the importance of commercial electric meters and all questions appertaining thereto, and in consideration of the highly technical nature of some of these questions, that a permanent committee be formed, the personnel of which should be one member from each interested operating company, to constitute an organization for the collection and distribution of data and experiences in connection with electric meters.

In order that a means may be provided for the proper operating of such a committee, consisting of members from different parts of the country, it is further recommended that it shall be considered the bounden duty of each member of the permanent committee to send a report covering all items of interest pertaining to the subject of meters to the secretary of this committee between the 1st and 10th of every month. It shall then be the duty of the secretary of this committee to edit these reports and combine them into one paper of more or less general interest, which may be presented at the annual convention, or, if desired, printed and sent to all interested companies before the convention.

With reference to the discussions of last year's Meter Committee at the annual meeting, we have been informed recently that as a result

of this some of the meter manufacturers are contemplating putting on the market shortly a kv.a. meter.

Respectfully submitted,

E. R. SPENCE.	A. H. WINTER JOYNER.
P. S. GREGORY.	WM. VOLKMANN.
LOUIS W. PRATT.	E. J. TURLEY, Chairman.

Mr. Turley: I have much pleasure in moving the acceptance of the Report.

Mr. Davies seconds the motion. (Carried.)

The President: Before the adoption of the report I do trust that this word "Discussion" on the programme may not be treated as a mere conventional observation. Generally speaking, it does seem to me that we make a great mistake here in not speaking out our minds more freely. There is one thing quite certain: the value of any discussion does not depend upon the words used. Individually I would much rather hear a man blurt out—I do not care in what order or what style—any words that really had significance in them, that bore on the subject, than I would listen to a man talking in a much more polished way, who knows nothing about the subject. Let me make the point clear. So far as I am concerned, I take positive delight in listening to any man who talks about any of those things which come up, so long as I see at once that he really knows his subject. You men, generally speaking, do know the subject; some of you know one part better than another part. A. knows one part and B. knows the other, and A. won't talk when his subject comes up, and B. won't when his does, and the result is that we do not get the value which we should get from the reading of these papers.

I say this with a great amount of feeling because, not only to-day, but in previous conventions I have had it said to me that members are not getting replies to questions which they put. There are men in the audience perfectly qualified to talk about the subject and they won't.

I will tell you what I am quite willing to do as Chairman: I am content to give you the absolute pleasure of not listening to a single remark from me to the end of this convention if in return those who know about these subjects will talk when the proper time comes.

Mr. Davies: Allow me to blurt a little. I will tell you, the difficulty to-day in the matter of discussion on these papers has been that there has not been anything that calls for discussion—in my opinion, that is. This particular paper is different from our usual standard Meter Report, concerning accuracy and the delicacies of new mechanism, etc., and it is a refreshing change to take up a fight with the Government regarding the excess amount of money that they take from us as companies for testing meters. Mr. Dion has always carefully instructed us that we have to go very quietly in this matter. I remember I broke into this thing in 1911. At that time the profit

was about $70,000 a year, and we sent a delegation to Ottawa to interview the Minister. The Minister was very nice, and is very nice, and the officer, Mr. Higman, is first rate, but you cannot get very far with the Department when you want to decrease their revenue. I think, perhaps, Mr. Dion will give us a word a little later on if it is opportune now to try and get some of this money spent for the benefit of the companies.

This particular paper does not bring up any contentious question, so far as I can see. I would like the committee to give us a little more information about such things as measurement of power factors on large loads and small loads, and I do not know whether they accumulated any information that they did not think worth while to put in the paper. If they have, I would be very glad to hear something about the way the different companies are taking care of this question. Otherwise, I do not know that I can blurt any more.

Mr. Gregory: In reply to Mr. Davies' question about power factor, the committee considered that the subject had been so well considered before in other papers that we did not like to embark upon it in a rather feeble manner in this paper, and we thought it better to treat on a question on which some action may be taken.

Mr. Davies: Allow me to add that I think the committee's idea of having a permanent meter committee is a very excellent one. I believe there are lots of things which go on—we know of them—which the committee could look after. It does not matter how small it is. Our organization is changing all the time. We have one meter man to-day and to-morrow he is general manager. They always graduate that way; I was a meter man myself. And in the meantime a new meter man comes in who has not all that accumulated stuff behind him, and it is a good thing to be always rehashing these problems that come up in the meter department. A good deal of good can be done, and I heartily endorse that suggestion.

Mr. Pratt: Mr. Chairman and Gentlemen, in reply to Mr. Davies' question as to the measurement of power factor, I feel diffident about getting up in this particular case because, like Mr. Davies, I was once a meter man, and have since graduated to the commercial end, but I have been unable to shake off the incubus of the meter department, so that I can still give a little information on that subject.

We have found, taking it all in all, that the most satisfactory way of measuring power factor on large power loads is by way of the two watt meter method, the formula for which can be obtained from the large manufacturing companies. Usually when a commercial man draws up a contract, with penalty or bonus, for power factor, he overlooks the fact that there is no stability to the power factor of the load. During certain hours of the day you get a high power factor and for the rest a poor one, and on that account it is usually very difficult to satisfy a customer where you are using a graphic instrument. Our experience has been, after using both methods, that

the two watt meter method, while it may give the customer a little advantage, is the most satisfactory one in the end.

Mr. Davies: Taking the average over the month?

Mr. Pratt: Yes. While I am on my feet I may refer to the Meter Committee's paper in relation to two matters. One is, of course, that we would like to see a reduction in the fees. At the present time the average cost is sixty cents. It is not very much. Personally I would like to see a rate of 50 cents all-round for all types of meters. There is very little difference in testing a very large capacity power meter than the ordinary house lighting meter. There is just one feature of a reduction in rates that we would do well to think about in connection with this agitation to put the measurement, or inspection and testing of meters in Provincial hands, and that is, as long as the Government gets a nice little surplus from testing meters it won't be any too ready to hand over the inspection of meters to the Province, and it would not be well for us to destroy that advantage which they now have. because I think we all know what the result will be in Ontario if the testing of meters gets into Provincial hands.

Mr. Turley: With reference to the power factor meter, one of the reasons that it was not discussed with the present Meter Committee is that it was covered by the National Electric Light Association, which report will be the property of the members of this organization before very long.

With regard to the question of Government testing meters. The idea which I had in suggesting that part was not so much in getting reduction of the rate—although probably all companies are interested in that—but to my mind the present system of testing is an absolute waste, not only of time, but of money. In our case we seal about 17,000 meters a year. Last year the cost to the Government was, I should judge, about $4,000 in labor and material. When we are finished with the meters we send them to the Government laboratory and they test them, going over exactly the same tests as we did. If you refer to the Government blue book you will find the number of rejections of meters is very small throughout Canada. The company must be very careful also, as if we wanted to beat the Government inspectors, so far as meters are concerned, it could be very easily done, since all they do is to test the meter to see whether it is one per cent. slow or fast, and all we have to do is to change the dials and the customer is beaten. They do not check for that. They do not protect us in any way. Therefore, if we are paying the Government they should institute some kind of test which would protect us as well as protect the public, or do away with it altogether. It is an absolute waste of time and money. There is another item which I did not mention, and that was the question of the length of seal of electric meter. The time now is five years. I think if that is traced back it will be found that it originated from the practice in connection with gas meters. With gas meters, the life is about five years, because

the leathers wear down and one thing and another, and it is necessary to bring them in, but the accuracy of the electric meter, after it has been in service five years, i.e.. the difference between the accuracy at the end of five years and at the end of eight or nine years, is very small. I think that we could reasonably ask the Government to extend the length of seal of the electric meter without injuring anybody outside of lessening the revenue that they get for it.

Secretary Volkmann: Of course, increasing the length of time is another way of reducing the revenue.

In connection with the question of the Provincial testing of meters rather than the Dominion, personally I do not approve of the Provincial proposition, as it means, instead of establishing one department to handle it, the establishing of a department in each Province, thereby increasing the expense of testing on account of having to have a staff in each Province.

I was very much interested in hearing that the Dominion Government maintained a complete standardization laboratory at Ottawa. I know that many companies situated in the Toronto district, when they want a meter accurately calibrated send it tc Toronto University, or if they want to get something better than that they send it to the U.S. Bureau of Standards. It seems to me it would be a mighty good act on the part of the Department to circulate the information that it is possible to get a precision meter calibrated at Ottawa.

In connection with the measurement of power factor, I attended one of the N.E.L.A. Meter Committee meetings at Springfield, Ill., the latter part of March. It would appear from the information that I got there that the Sangamo Company have practically developed a meter of the integrating type which they think will measure kv.a.h., although it will penalize if it is used as a polyphase meter on a three phase unbalanced circuit. The amount of those penalties, however, cannot be properly worked out or defined until the committee dealing with the definition of power factor has brought in its report. I believe that the General Electric Company and also the Westinghouse people are working on some method of measuring kv.a.h., both single phase and polyphase.

With respect to the experience of our own companies, the Toronto Power Co. more particularly, and the Toronto Electric Light to some extent, we have quite a few different types of power contracts; contracts in a way being adapted to the use to which the power is put. We have some contracts that are strictly kv.a. contracts, in which one kw. is equal to one kv.a. There is one in which the power is measured in kw.h., and then converted to kv.a.h. In this instance we install two watt hour meters, one of them operating to record kw.h., and one connected to read the reactive volt ampere hours, and from the readings of these meters the average power factor is calculated for the month. At the end of the month if the average power factor for the month is below 90 per cent., then they are charged for 90 per

cent. of the kv.a.h.; if above 90 per cent., they are not penalized for power factor, but are charged for the kw.h. only. We had another large contract in which a similar scheme was used, except that the power was billed on the basis of the maximum ten minute peak. This being a furnace load, the load at times was likely to be unbalanced, so that a graphic power factor meter would not record the correct power factor. In this case a graphic watt meter was installed to read the reactive volt amperes, and if the power factor was below 90 per cent. at the time of the peak, then 90 per cent. of the kv.a.h. was used instead of kw. We have other contracts in which one kw. is equal to one kv.a. All our large contracts are made on basis of penalizing for low power factor. Wherever the customer has a well balanced load the graphic power factor meter is used, as there is no question of the accuracy of the power factor meter on balanced loads if properly rated and installed.

I might say that the question of the measurement of power factor was taken up in the Meter Committee's report of last year. The present status of the art is practically the same as then, and these methods I have just noted are fully outlined in last year's proceedings, with diagrams, etc.

Mr. Davies: I was going to say that while these methods that Mr. Volkmann refers to give results, we are not perfectly sure that they are fair. Is it fair to charge a man for his average power factor? You have got to face this thing pretty soon. Now, we want to go very slow in establishing methods of billing for power factor, because if we get to a point where we standardize a method that is not fair we may have to face some very large rebates if the point is ever decided against us. It is a very important point.

Secretary Volkmann: Well, in that connection there is no technical definition of power factor for polyphase circuits. I have in mind one case involving a considerable sum of money, in which the contract called for a minimum payment of 75 per cent. of the contract amount whether taken or not, and for the power between 75 per cent. load factor and 100 per cent. load factor there is a sliding scale of rates. If power is taken at 100 per cent. load factor during the month the rate is 1¼ cents per kw. hour for all kw.h. in excess of 75 per cent. load factor. This is essentially a kw. hour contract, but there is also a provision in the contract which states that during any period, if the power factor falls below 90 per cent., then 90 per cent. of the kv.a.h. during that period is to be taken in lieu of the kw.h. The power as taken included a considerable correction for kv.a.h. below 90 per cent. This contract has been before the court, and so far as any decisions that have been handed down at the present time, that has been sustained.

Mr. Pratt: In connection with Mr. Davies' remarks about exercising due care in defining what power factor is, the important point, to my mind, whether the result is what both parties seek to obtain

is correct or not, the important thing is to clearly define in the contract just how the power factor shall be measured, and if the customer consents to that it should eliminate any chance of legal battle on that point. He knows before the contract is executed by what means the power factor measurement will be attained. And if he gives due consideration to that, submits it to his technical men or his engineers, there can be no hardship or unfairness.

Mr. Davies: This is getting to be quite a discussion. We have been on big power contracts up to date. I would like to bring this down to small loads, as to what method to take in reference to small kilowatt loads of say 20 kw. That is an ordinary small simple standard contract, without any special agreement. I would like to know, generally, what is done in that connection.

Mr. Gregory: I would like to ask for a little further explanation as to why the experts considered the measuring of customers' power factor on the average demand unfair?

Mr. Davies: Well, because the expert point of view is, especially in regard to water power, that the demands upon the system is the thing that costs the company money, and he is interested in the demand—either at the maximum demand of the customer or more fairly at the time of maximum of the company. But it is going to be very difficult to take everybody's test at the same time. So he goes back to the maximum demand of the customer, and he does not see why the customer should have his bill raised for some low power factor he may have put on at the time of low demand of the customer which does not hurt the company in any way. That is the expert point of view. It is a question whether the company is penalized or hurt if generating by water power in any way by low power factor at low loads.

Mr. Gregory: It seems to me it would be a very difficult thing to enforce, because you would have to measure the power factor of each customer at peak load.

Mr. Davies: He does not go as far as that. He takes it at the peak load of the customer, but really, fairly speaking, it should be at the peak load of the company.

Mr. Dion: Notwithstanding your kind invitation to remain seated, I am a little tired sitting down, and so you will pardon me if I stand. I might say that in the City of Ottawa, where the Hydro is operating, the rates and the conditions under which they are applied have to be approved by the Provincial Hydro Commission, and there is a tariff in force for power where no account is taken of the power factor, except possibly in this way: A fixed rate is paid first, and then a meter rate is added. The fixed rate of so much per month is based on the size of the motor. So that for a low power factor load due to the under-loading of the motor you get some relief. That is the only way in which they take care of power factor conditions, and we have to comply with these terms because that is as far as they

will go, as they have been approved by the Provincial Hydro Commission.

With regard to the inspection of meters, Mr. Davies seems to think that I have been advising him to be very careful in approaching the Government. I cannot just remember ever stating that. It is quite possible I did under some conditions, but it seems to me they do not exist any more, and I see no particular reason at this time, from any knowledge I have of local conditions, why the Government should not be approached for another reduction if, in the opinion of the Association, it is due.

When we have approached the Government on different occasions with the same object in view, we have always been told, "that the Government was not anxious to reduce the fees, but rather anxious to use the excess revenue in improving the service. It is true there is an excess of revenue, but we intend to employ better men, more competent men, give them greater salaries, and generally improve the service." I leave it to the members whether that has been carried out, whether any material change has been made in the inspection service. The Government undoubtedly has a large surplus. I think, up to this time, since they instituted this inspection service they must have over $200,000. That has gone into the general funds of the Government, and they seem to be loath to part with any of it. However, we have obtained reductions in the past, and it is quite possible we might obtain another one.

But I think if a deputation was appointed to interview the Government on that subject it should also take up the question of service and such things as have been mentioned in the report of the committee about extending facilities for calibration of master meters for the various companies. I think that might very well be taken up and we would have very good grounds for asking for this special service, regardless of cost, in view of the surplus that the Government derives from our inspection fees.

There is another point, which escapes me at the present moment; I may perhaps think of it later.

The President: I feel rather hopeful; we are getting a lot of discussion now.

Mr. Wills Maclachlan: There are one or two points—I do not want to sidetrack the discussion that was going on, but I have had brought to my attention the hazard that the meter man is in in reading the average meter. They are in dark holes, and in all kinds of places; in a number of cases the meter men are using matches, because, I understand, these electric torches have not proved successful; I would ask that meters be placed in easily accessible locations.

I know, in the City of Toronto, both in the Toronto Electric Light and Hydro, during the coal shortage, some meters were covered up with coal, and very difficult to get at; in some cases the meter man had to help pick out the meter before he could read it.

The President: Have you any practical suggestion to make as to that?

Mr. Maclachlan: The location of the meter is, to a very great extent, in the hands of the company. I would suggest that they place the meters in easily accessible places so that they could be read.

Another point: In demand meters or making demand tests there ought to be some means so that the fuse is left in circuit while the demand test is being made. In a great many cases in making demand tests the fuse is taken out, as the demand test is made under load and the temporary connections are made and then the fuse removed, so that the testing meter is cut in where the fuses were. I know, over on the other side of the line, means have been made to have those demand tests made without any hazard to the meter reader.

One point in connection with the Inspection Act and in connection with the surplus. As Mr. Dion said, over $200,000 surplus has accumulated during the last nine years, but there is a deficit on the gas meter side, so that those who are interested in gas meters and electric meters would want to look into the gas meter side as well.

Mr. Turley: Now, the reason for the deficit, I imagine, in connection with gas meters is that there are so many small companies around operating gas meters. They seal possibly only a dozen gas meters in a month, and as it is necessary for an inspector to go out to these small towns, the revenue which he derives from sealing those meters is very small.

In connection with our company last year, our gas meter seals cost us about $11,000. Two men did all the work in connection with that. Now, again, I say that work is absolutely useless. I think if we got after the Government and, instead of having inspectors, having a competent man to go around and find fault with your system of checking, and then probably have another fellow who will just stick seals on the meters, or, if you like, give us the seals and let us stick them on. I think this would accomplish just as much good, at a very much lower expenditure, not only expenditure, but decrease the work, because it is doing work which we have done, and which accomplishes nothing after they have done it.

The President: I think that is an exceedingly interesting observation, and that if you would get up some concrete instances, some definite instances, so that this will appeal to the minds of those reading, it would do a lot of good.

Mr. Turley: The only objectionable reason to doing that, unless you start out and go right through with the thing, if you should present only a few cases, they could start and make it uncomfortable for you, and you know how uncomfortable a Government inspector can make it for you if he wants to. If you get an organization such as this to draw up a scheme which they think is fair and reasonable, and which has the benefit of their experience, I do not see that the Gov-

ernment can do anything but make a law that will meet with your requirements.

Secretary Volkmann: Mr. Dion, are rates for inspection of meters made by the department, or written as part of the Inspection Act?

Mr. Dion: No, the Governor in Council can make rates from time to time.

Secretary Volkmann: Do you find it necessary in Montreal to send all your meters to the Government laboratories to have them sealed?

Mr. Turley: Yes.

Secretary Volkmann: Do they not come to your meter department and seal them?

Mr. Turley: We have given them space on our property, and we have put through, daily, during the months of February, March, April and May, an average of about 110 gas meters and 150 electric. It used to be necessary to send them down to the Government laboratory to have a seal put on. One of the troubles was that if you sent them down on a cold day in winter your meters would be wrong. We then gave them space in our place, there are four men testing these meters, and we have to ship the meters in to them and bring them back. Whereas, if they had their man standing behind our man and sticking the seals on the meters they would very seldom find one wrong.

One thing I can say for the Montreal inspection department, they really test every meter. They do not take any chances. They test every meter, the same with the gas and electric meter. They really do the work which they charge for. Some years ago I told them that if we were paying for the thing we wanted them to do the work.

Mr. Dion: If it is preferable to have a Government inspector stand over the company's man while he is making his test to see that he does it right, and stick a seal on the meter, that can be carried out without any change in the Act. It is purely a matter of routine. The Chief Inspector can authorize that if it is a saving of time and a convenience, the Act allows it.

Mr. Maclachlan: There is a precedent for that. In the old Electric Power Co. days it was done all the time. The inspector from the Department simply went along with the meter man and they checked together. Two separate tests were not made.

Mr. Dion: One more word. I forgot to mention that I do not share some of the views expressed here as to the danger of the matter of inspection becoming a matter of Provincial jurisdiction. No doubt the Ontario Provincial Board would like it done, so far as Ontario is concerned, but the matter of weights and measures, of which the inspection of gas and electric meters is part—the inspection of weights and measures is fundamentally, under our constitution, a question of Federal authority. In view of this it is unlikely that any part could be separated from the rest.

The President: You mean you are not fearful about it, because you think it quite impossible of attainment under the British North America Act.

Mr. Dion: Yes. Another matter. We have had this very excellent report, containing suggestions and recommendations. This morning we have had several other reports from committees, also making recommendations. Now, are these reports going to end here? Are they simply going to be printed in the records, and that will be the end of the matter? I would urge upon the coming Executive as one of their first functions after this convention, to take each of those reports into consideration and study each recommendation with a view to taking some action on it, if desirable; otherwise the work of this convention will be largely lost. I feel that the members of the Executive probably think just as I do about this, but I feel it almost a duty to sound this note in the interests of the Association, this thing should be gone through systematically, so that the men who have labored on the committees and made the recommendations should not see their labor lost.

The President: I should like to make a remark in regard to that last observation, that not only should it be dealt with by the coming Executive, but I think it might be dealt with in part at our meeting of the Executive to-morrow. I think we should act at once on some of those concrete suggestions.

Mr. Turley: You spoke some time ago of discussions on papers. It has been my experience in connection with other associations and societies that any meetings that they have where technical papers of any kind are discussed, if those papers are printed some time before the meeting and presented at the meeting, the men who come there come there prepared to discuss them, and they have the points looked into. And in connection with the Engineering Institute I have remarked at numerous times that when there is an important paper to be presented it is printed a long while before and sent around to the members, and that paper gets full discussion. Another paper, which is probably just as important, but is not considered so by some of the Executive, is not printed, and the result is when it comes to the meeting it is presented to the meeting, but there is very little discussion on it. Do you not think it would be possible in connection with this Association to have your papers for your annual meeting printed and sent to the members, say, a month before the meeting, that you would get better results from your papers?

The President: A member has invited a reply from me, and I should like to say just a word or two about that. The subject has been alluded to by others to me; I heartily concur in the suggestion The difficulty is a particularly practical one, and I hope to deal with it to a certain extent during this convention. Frequently in other years it has been exceedingly difficult to have the committees appointed until a long time after the convention has been held. So far as I

know of the average time, we succeeded rather better last year than in previous years, in getting committees definitely designated. This year we hope, before this convention breaks up, to have the committees themselves named, so that we are that much ahead. If we fail to do that we shall fail in spite of our hope to accomplish it. Now, of course, the earlier we can get the committees to work, and the earlier that the various members of the different committees realize that there is some actual duty and responsibility in respect of the membership of the committee, the more likely are we to arrive at this very desirable end of having the papers ready in such a time that, through the medium either of printing, if we can afford it, or typewriting if we cannot afford printing, we can distribute copies of the papers in advance of the convention.

Of course, answering the question put to me, obviously I think we are likely to have better discussion if the papers are known to the various members before the convention itself takes place. But even though I quite admit the force of that, yet I do feel that even under existing circumstances we might have more discussion than we, in fact, have. It has been demonstrated during the discussion on this last paper, when the members have really applied themselves and have listened very carefully to the points raised and have dealt with the points which are of interest to them. At the same time I wish it distinctly understood as being thoroughly in sympathy with this suggestion of getting the papers earlier.

I should add, in fairness to the Secretary-Treasurer, so far as this present year is concerned, I know he has gone to great trouble and pains in getting the papers together at as early a date as possible, and I do not wish any remarks I make to be felt as a criticism against members of the committee. I think the criticism should be directed against the Association itself. Perhaps we all hitherto have not been up to the mark in respect of getting things ready in time so that matters may be dealt with.

Mr. Dion: Another thing that occurred to me, upon which I would like some information in connection with the meter question. The practice has developed in our city, where electric ranges are installed, of putting in the three wire system, some of the burners being put on one side and perhaps the principal consuming device, such as the oven of the range, on the other side. Now, a fuse blows and the meter stops registering. Some customers have found that out, and they made a practice of taking out one fuse when using the oven, so that they could do considerable cooking operations without any registration whatever on the meter. I took the matter up with a manufacturing company and they told me that it was quite impossible in the present state of the art to produce a three wire meter which would be free from that objection, one that would register when only the neutral and one side were on, the other being open. I wond-

ered if other members had met with this condition, and how they had handled it.

The President: Might I ask if there have been any suggestions made of making the act criminal in any way?

Mr. Dion: No. The thing is criminal, of course. We have legal recourse against such customers, but the difficulty is in catching them at it.

Mr. Gould: Criminal action?

Mr. Dion: We had evidence that it was intentional only in one or two cases.

Mr. Turley: That brings up the question that was suggested to me some time ago, it was with reference to installing meters without any fuses on them at all, installing them right on the main. One of the reasons that it was suggested to us is that we have a lot of trouble in Montreal with people stealing current, and they will steal it right from the fuse, and if you cover everything right up to the meters you still have the fuses. It has been suggested the last couple of months that we put our meters right on the main, without fuses or anything else.

Mr. Dion: We could not do that in Ontario under the regulations.

Mr. Maclachlan: Your fuses have to be sealed.

Mr. Turley: How do they look after that when they blow?

Mr. Maclachlan: The company looks after it.

The President: Any further discussion on this interesting paper in reference to meters?

Mr. Anderson: In this question of power factor penalty there is a question that comes up to me, and I do not understand why this is not more thoroughly gone into, and that is when we are making a contract with a customer would it not then be a good time to go into this matter thoroughly with the customer, and induce him to put in synchronous motors. If he agrees to that give him power slightly cheaper, with the understanding that he keeps it 95 or unity power factor.

Another part of the discussion which is not very plain to me is the method of determining power factor.

All that has been talked about, to my knowledge, is some method of arriving at the average power factor, and there has been no discussion of how to find the power factor at the maximum load of the customer. If we found at his maximum load that the power factor was low we could increase his demand as well as making him pay a penalty on average power factor. Is there any method of finding power factor at maximum load except with the expensive graphic metering apparatus, which to a small customer is not warranted? These, to me, are real live questions and should be thoroughly discussed.

Mr. Davies: About the first part of your question in regard to basis for power factor, I have some answers to that very point in the report which I will have to read in a few minutes.

Secretary Volkmann: In connection with measuring the power factor of small loads, there is absolutely no way of doing it commercially except to install a single phase or three phase graphic meter. The expense of an installation is about $350, so it all depends on what revenue you get from the customer as to whether this more accurate installation is justified or not.

Mr. Anderson: On a customer of 100 h.p. or more we have experimented by putting on an "R.O." 3 phase maximum demand meter, and two "R.O." single phase maximum demand, R.O. Westinghouse, and on a fair sized customer of 100 horsepower up we find it best to put those in. Has anybody else tried this?

Mr. Davies: That is a very good solution.

Secretary Volkmann: We have not used that method in Toronto, neither have we ever used the single phase watt hour meter method, for the measurement of power factor; we do, however, make occasional checks on small loads with portable single phase indicating watt meters.

Mr. Anderson: Just a visual test like that might not mean much.

Secretary Volkmann: The contract states "when the connected load is over 5 h.p. that the maximum demand for billing purposes, at the company's option, may be taken as 90% of the first 20 h.p. of connected load plus 60% of the remaining connected load, or shall be determined by test." The meter test is taken once every two or three months. Of course you are liable to lose revenue in some cases and gain in others, so that on the whole you will average about the same revenue as you would obtain if all maximum demands are taken correctly.

The President: We have at last demonstrated that we are quite capable of discussing the thing fully.

It has been moved, and I believe seconded, that this report of the Committee on Meters be adopted. Those in favor will say "Aye." (Carried.)

Now, the next paper which we shall have the pleasure of listening to is that by our friend Mr. Davies. I invite the closest possible attention to the various points, and discussion on them when he is finished.

Mr. Davies: Our report this year is not very long, and we must admit if the report had to be printed we would be very much behind. It is a very hard matter to get answers by correspondence and to get a report together. It is very difficult indeed, even if you start it as early as January, as I did; it seems to be impossible to get it all together, and even now, after having worked since January, we found it necessary to condense reports considerably.

REPORT OF RATE RESEARCH COMMITTEE.

P. T. Davies, Chairman.

Montreal, June 9, 1919.

The President and Members, The Canadian Electrical Association.

Gentlemen: Your Committee begs to report that they have carefully watched the rate situation during the past year and have not found any radical departures from established practice nor any new instrument for the measurement of the factors involved in rate making. The sudden cessation of industrial activity due to the armistice, without any corresponding increase in normal commodity production, has created a situation in regard to earnings which might easily produce a tendency on the part of companies to demand the letter of the contract in the case of those agreements not due for expiry at the armistice time, but in regard to which the demand for electricity ceased.

Your committee was asked to discuss this phase of the question, but feels that such matters are generally of a local and special nature, and has decided that even if a unanimous opinion could be given as to procedure, it would not be wise to give it.

There is one angle of the rate research question which will need very careful study in the near future, that is, the question of increased rates. The rapidly diminishing purchasing power of the dollar has created a necessity for increased wages and salaries, which at some time or other must be passed on to the customers, unless the industry wishes to become the "poor sister." The rates which are now normally obtained in Canada are often less than 50% of the rates which are obtained in the U.S.A. While these rates in the past have been adequate in most cases, it has only been because of careful management and minimum staffs that they have been possible.

The rates for electricity for the ordinary householder have been cut in half during the last ten years. The purchasing power of money has decreased 60% during the same time, therefore five times as much electricity can be bought for the equivalent value to-day as was possible ten years ago.

Your committee believes, therefore, that all member companies should at all times bear in mind the fact that increased rates will be necessary in the near future, and should take such steps as will ensure the cordial reception by the public of these increased rates.

The recent history of the street railways of this continent has been a memorial. Practically all are now in the hands of receivers, notwithstanding increased rates. The reason, of course, is that when street railway fares get above a certain point people prefer to walk. The most recent trend of action is towards bonusing tramway companies direct from the rates and spreading the load over the whole community.

In the case of electricity for lighting and power purposes, however, the competitive mediums have all risen to many times their old value, and the purchasing power of the public in dollars has increased so considerably that increased rates will not drive away the business. Recently the Montreal papers have been carrying advertisements showing the wages which have been obtained by the 3,400 employees of a large shipbuilding company. In 1914, the average wage of the workmen was $697.00, to-day the average wage is $1,723.00. This increase is typical and shows the rapidly widening clientele to be obtained.

An Act to provide for the regulation of public utilities has been adopted by the British Columbia Legislature, March, 1919. This Act is very complete and, as far as your committee can see, a fair and reasonable one. Some points of special significance are that a Public Utilities Commission of one person constitutes the authority for carrying out the operations of the Act. There is, however, the right of appeal from this Commissioner's ruling to the Court of Appeal for the Province, on questions of law and jurisdiction, and, under certain conditions, the right of appeal on any point whatsoever. The Act gives the Commissioner the right to carry out an appraisal of any company and to charge the cost of such appraisal to the company in question. The amount of such cost to the company, however, is permitted to be charged by the company to capital account and added to the value of its property.

The Commission can ask for practically any information and require any kind of record to be kept, and the Act provides a penalty for any employee of any company who fails to carry out the requests of the Commission. This penalty is limited to $200 for each offence. If, however, the offence is committed by an employee acting under orders from a superior officer, then the Public Utility Company shall be liable to a penalty up to $1,000.

Your committee has issued a questionnaire in order to obtain the consensus of opinion on various questions which have been brought up, and the answers to those upon which any unanimity has been shown are presented herewith.

In conclusion, the committee wishes to pay particular tribute to Mr. S. J. Halls, a new member of the committee representing British Columbia companies, whose work has considerably aided the committee this year.

Respectfully submitted,

J. B. WOODYATT.
D. H. McDOUGALL.
S. J. HALLS.
L. W. PRATT.
P. T. DAVIES, Chairman.

I will now pass to the questionnaire, and I would ask, Mr. Chairman, if we can get discussion on these questions singly? We received five answers to this questionnaire.

Questionnaire.

(1) What is considered a fair gross return on new capital outlay for new customers, and does such capital outlay include a proportion of apparatus back of extension and meter?

Answers.—The information received indicates from 33 per cent. to 100 per cent. without meters—the average being 50 per cent. of the cost of new extension without meters.

(2) In cases where limits fall outside of (1), above, are customers charged with extra cost?

Answers.—In all cases the additional cash expenditure above the limit set by company is provided by the customer, the extension becoming the property of the company.

It is suggested also that the cost be spread over a period of one year, thereby encouraging the general use of appliances. This can be done by increasing the minimum monthly payment by an arbitrary figure to cover the additional cost, and in this manner encouraging the use up to this minimum each month or by rebating 10 to 25% of the monthly bill in excess of a normal minimum and crediting such rebates against the extension.

The President: That is rather a question of fact rather than discussion.

Mr. Davies: Yes, some of them are questions of fact.

(3) Is any bonus given for good power factor, and what check is taken to see it is maintained?

Answer.—No bonus in general use.

I do not know whether any discussion could be had on this.

The President: It is a discussable matter. It was discussed at Atlantic City.

(4) Is any recession allowed on demand charge after a peak has been established, and if so what amount and when?

Answer.—No recessions except when anticipated and provided for.

(5) What percentage of connected load is taken as active load when tests are not taken, and how does this percentage check with average tests taken to verify this figure?

Answer.—Full rated capacity of apparatus taken.

(6) What rates for Tank Water Heaters and what size is satisfactory?

Answer.—$4.00 per K.W. per month for 1,000 watts, when a double throw switch is used with stove; 750 watts is satisfactory in most cases.

The following questions have also been asked by member companies in answer to questionnaire, and are open for discussion:

(7) When is lighting permitted to be charged on power rates?

(8) In cases of apartment houses where wiring is mixed up and the subdivision of apartments varies so that no one meter will always control the lights in one suite, and owner refuses to pay on a master meter, how do you arrange for service and billing?

(9) Cannot member companies follow the lines of the gas companies in New York and charge for all services from the street?

Mr. Davies: There are two points there that I think can be discussed. The first is, when lighting is given at power rates, and the second is, whether the convention can agree that it will be a good thing to have all services from the streets to the customers charged to the customer.

Secretary Volkmann: With respect to service charges, during the last year or so it has been the policy of our company in Toronto with the small residence customers to charge them on time and material orders for making service connections, because the revenue derived from the average house customer is about a dollar a month, and considering the equipment it is necessary to install in order to serve them, the revenue you receive hardly justifies the company even putting in the service.

We have some residence customers that are fed from underground services. These services we always put in on time and material orders.

Mr. McDunnough: I would like to ask Mr. Volkmann, if there was no opposition in Toronto, would you make charge for overhead service, because services once installed would be always revenue producing, while in our position you might have a customer there this year and next year he might go over to the opposition company and you might be obliged to take down the service wires?

Secretary Volkmann: In very few cases are the service wires taken down; as a general rule the service is disconnected at the stand pipe and left there.

In regard to the charging for services, if there were no competition the rates in all probability would be slightly higher; there would not be the extremely sharp competition there is at the present time, and there would be some reason for the company standing the cost of putting in the service.

Mr. Davies: My own opinion is that the companies put the service in from the street to the house; I do not think you can ever hope to extend the business if you make the customer pay everything back.

Mr. Anderson: May I ask a question on Mr. Davies' paper, because customers of 100 horsepower and over should have a maximum demand. How would you base those, on a visual test or recording test?

Mr. Davies: Two ways of doing it. Some companies maintain graphic meters that they install upon the premises for a week at a time, or the most usual way is to take a watt meter and make a test on the premises and try and get what the man's normal demand is. I do not know that that is any better than taking percentage of

the connected load. For instance a man in the 75 hp. class, he may be tested three times a year. A man in the 50 hp. class may be tested twice a year, and a man below 50 hp. tested once a year.

The President: I do not know that we have heard anything on that other point that Mr. Davies alluded to, as to lighting on power rates. There are those two things open for discussion.

Mr. Pratt: Mr. Chairman, with reference to the subject of lighting at power rates, there is a pretty general impression among companies which do not make it a practice of giving lighting at power rates, that this is selling lighting too cheaply. Our experience in Hamilton has been it is very satisfactory in respect to customers over 50 hp. We find it stimulates the connected load in lighting. We have three customers with connected lighting load in excess of 400 hp. each, one with a connected lighting load of about 700 hp., and when you consider that connected load has to be counted into the connected load for minimum charge, it is quite a consideration to the company.

It also remedies a great deal of dissatisfaction where a customer, a factory using a large quantity of lighting, pays for his lighting on the regular lighting rate and pays for his power on a special power rate. To the average purchaser juice is merely juice. There is nothing particularly tangible about it from his standpoint, and he cannot see why he should not get his lighting as cheap as he gets his power. Under those conditions we supply the power for lighting from the same circuit as the power, which simplifies things very considerably for us. Otherwise, he might be inclined to demand lighting from a separate lighting circuit and in many cases where these large factories are located on the outskirts of the city, it might mean a considerable additional expense. We find that lighting forms a very considerable portion of our revenue from power customers, and we do not consider that we are losing anything by adopting that practice.

Mr. Woodyatt: I agree with Mr. Pratt in the case of a large customer, in the case of 700 horsepower, lighting connected, but with smaller customers he spoke of—

The President: 50 horsepower he gave as minimum.

Mr. Woodyatt: He spoke of supplying them all from the same circuit. I suppose some customers about that size are supplied from your power secondaries at 440 or 550 volts, and in those cases the lighting circuits would have to be separate anyway, so that part of the objection to the different rates would be removed there.

The President: Have you anything to say about that?

Mr Pratt: That is, our standards are 2,200 and 220 volts, and in most cases the lighting is taken off the power transformers, and no additional transformer capacity required. In some cases we provide special transformers for lighting where voltage perhaps is off the standard.

Secretary Volkmann: In Toronto we have three different types of contracts: A residence lighting contract, a commercial lighting contract, and a power contract, all carrying different rates. All residence lighting carries two rates—one in direct current district and another in the alternating current district. The commercial lighting, that is store lighting and general commercial lighting, is taken care of on the commercial lighting contract. All power is furnished on the power contracts; there are a few cases in which a certain amount of factory lighting is taken from the customer's power service, in which case they put in a transformer and convert from 550 volts to 110 volts or 220 volts, and in this way they take care of their own lighting.

Mr. Davies: Is it permissible for any customer to put a transformer in and take his lighting at power rate?

Mr. Volkmann: Yes, it is permissible.

Mr. Gould: In our case, the power we sell direct, or retail rather, is not very great. We wholesale the most of it to the Hydro-Electric Power Commission, using graphic recording meters. Where we light some factories, the power requirements range from 15 horsepower for the lowest up to about 60 or 70 hp. at the highest, and we charge them an average rate of so much per horsepower per year on the rated capacity of their motors, and allow them to light their factories from the power circuit at the same rate.

The President: Is there any one else who could give us something on this? It is practical.

Mr. Maclachlan: There is one point that was not touched on: the increase in the cost of living—its effect on the rates. The Minister of Labor, on May 12, in the Senate, advised that the increase in the cost of living from 1900 to 1914 had been 35%. I have just completed an investigation into the increased cost of living in Ontario from June, 1914, to April of 1919. It is 78.2 per cent. or, practically speaking, 80 per cent. That is, taking the calculation from 1900 to date, your dollar was worth 2.43 in 1900, or your dollar in 1900 is worth just 41 cents now.

Mr. Dion: You do not mean the cost of higher living?

Mr. Maclachlan: No, that is taking it on a mechanic's type of living. The cost of same articles of food, the same articles of clothing, rent, and sundries, and fuel, comparative figures for the same articles, the increase has been from 1900 to date 143%.

The President: I wonder if Mr. Gale has anything to say on this subject.

Mr. Gale: I might ask a question. Are moving picture machines charged for—whether charged on power rate or lighting rate?

Secretary Volkmann: In Toronto it is taken care of on the commercial lighting rate.

Mr. McDunnough: In Quebec we usually make a straight rate of 5c a K.W. hour, as compared with domestic rate of 7¼c.

Mr. Davies: A man that puts a motor generator set in; we give him that rate, but if he puts it in straight he pays the ordinary lighting rate.

Mr. Dion: The same in Ottawa.

Mr. McIntyre: That is exactly the same practice.

Mr. Woodyatt: That is, the mere intervention of a motor-generator set changes the rate. Why?

Mr. Dion: Because it is power in that case.

Mr. Gould: Something was said about water heater. There is one in my house. I have an electric range, with water attachment, also a water coil in the furnace, and between the whole thing we manage to get hot water. We find it takes an hour to heat 15 gallons of water with this 3,000 watt heater I had some kind of an argument with engineering gentlemen at this convention at Ottawa about a year ago about hot water heaters, and I still stick to what I said then, that a hot water heater for the ordinary house that has not a capacity of at least 3,000 watts I think is no good. We could not, in our house, do anything much with anything less, and we can heat as hot as you require 15 gallons of water in an hour with a 3,000 watt heater. We buy our electricity now from the Hydro-Electric System locally. Our cost is based to a certain extent on the floor area. In our particular case the floor area, I think, is 60 cents a month. We are charged for the first 60 kw.h. at 3½c a kilowatt hour. For all we use in excess of the 60 kw.h. we pay one and three-quarter cents a kilowatt hour. Our household expenses for the electricity amounts to $5 a month in the summer and about $8 a month in the winter, and we could not get along with the hot water heater if it did not have a 3,000 watt capacity.

Mr. Turley: I had given to me about two weeks ago for a test an instantaneous electric heater; I do not know whether anybody has seen them. This one operates on 220 volts, and I just forget the figures as to the quantity of current it used, but I think it was 7½ amperes, and you could run hot water out of it just as soon as you turned your tap on; it ran out a fairly good stream. I made a comparative test against a gas heater and found the electric, at 5c per kw.h. as against 80c a thousand for gas, that the electric cost was four times what the gas was. It is rather an interesting piece of apparatus. I think some agency in Toronto has it, and it is used in New York quite extensively. Just turn a tap on and hot water runs out. The apparatus is about 4″ in diameter and about a foot high.

The President: It is pretty expensive.

Mr. McDunnough: The heater referred to I think is the Geyser water heater. I think you are out on your capacity of that. We have one, which has a capacity of 3 kw.

Mr. Turley: All I remember is comparing it with the cost of a gas water heater; figuring the electric current at 5 cents and gas at 80 cents it cost four times what the gas did.

Mr. McDunnough: This heater was entirely unsatisfactory. You turned the tap one way, and it ran cold. When running hot it would not furnish enough hot water for bath, as water would cool in bath before bath was full.

The President: It would be very expensive.

Mr. McDunnough: No, it would depend; on the rates we sell it in Quebec it would be.

Secretary Volkmann: Mr. Gould, have you lagged your boiler with a heat insulating material?

Mr. Gould: The boiler is not lagged, neither is the heater. We are going to have them lagged to see if it makes any improvement.

Secretary Volkmann: We use a covering on boilers of about an inch of hair felt, and use a three heat heater, 500-1,000 and 2,000 watts. The 500 watt connection will keep the tank hot and supply sufficient for a small family. If you have exhausted your supply and want some hot water in a hurry you can get it by switching on the higher heats.

Mr. Gould: That is a good plan.

Mr. Atchison: On the question of lagging for tanks, we previously used a lagging which we purchased from the Canadian H. W. Johns-Manville Company at a cost of about $6.73 per tank. As this amount was a very considerable item in the installation of a water heater we decided to make something up ourselves. We are now using a hair felt insulator with a canvas cover, which costs us between $1.75 and $2.00.

The President: The discussion on this subject has been exceedingly interesting. It is quite evident to me that Mr. Davies did not indicate to us at all fully the amount of labor that the committee went to in getting this information. It has been moved and seconded that this report be adopted. Those in favor say "Aye." (Carried.)

The next order upon the paper is Report of Committee on Commercial Light and Power Sales, and we shall have the pleasure of hearing from Mr. Beaumont now for himself and not for another.

REPORT OF POWER SALES COMMITTEE.

R. J. Beaumont, Chairman.

Mr. President and Members of the Canadian Electrical Association:

Your committee are this year presenting their report with but slight modifications in the general form as presented in previous years. A brief survey of the field is dealt with in the first part, with certain subjects given extra attention at the end of the report.

Lighting Sales.

Residents and Store Lighting.—During the period under survey there have not been any marked developments in this phase of the work. The absence of development is probably due to the pressure

of war work. However, one particular fixture is rapidly gaining a certain amount of popularity, and is a form of semi-indirect lighting which is particularly interesting in that it allows of the use of nitrogen-filled lamps for domestic lighting, thus making it of great interest to central station companies as a means of increasing load.

Industrial Lighting.—Industrial lighting on the other hand shows considerable development, and probably for the same reason, pressure of war work in the extensive production of munitions. In certain places in England and the United States it has been found that surprising results have been obtained by the way of increased production due to correct and improved lighting.

For specific details as to the actual work done we would refer to the proceedings of the Illuminating Engineering Society, but would here emphasize this matter as being of the greatest value to lighting companies as a direct means of immediately increasing revenue.

Outdoor and Street Lighting.—Very little development has taken place in this field except the growth of the use of ornamental underground lighting systems fed by armoured cables, taking advantage of the flexibility afforded by the incandescent nitrogen-filled lamps.

The question of rates on long term contracts made some few years ago is in some instances seriously affected to-day by the high cost of lamp renewals, so much so that it would appear in some cases that the systems can barely bring in a return sufficient to cover a small interest on the money invested, and some central stations are basing rates with lamp renewals as a definite extra variable.

In connection with daylight saving, one of the most interesting subjects for consideration during last year, it may be said that to-day the lighting companies are in a position of knowing the worst and that daylight saving from the point of view of decrease in revenue is, after all, not a very serious thing. At the outside the effect on lighting earnings over a year does not exceed a figure of 5 , which checks up very reasonably with the estimated reduction.

Power Sales.

The sale of power during the period of consideration was, in the early part, more or less normal. However, there was not any very marked increase by the way of establishment of large plants such as occurred previous to that time. The signing of the armistice, of course, seriously affected the sale of power and to a less extent the amount of power used.

With regard to the amount of power used, in almost every case where large systems are concerned it was found that the decline in load did not at all assume serious proportions previously estimated, and that in some cases where a wide service of large capacity was delivered the amount of power delivered was practically only reduced for the period between the signing of the armistice and the end of 1918.

The present time is one of development, stabilization and return to pre-war conditions. Numerous projects covering a wide variety of productions are under consideration, and from the power sales point of view there is considerable work to be done. The immediate future holds a promise for the sale of a considerable amount of power, possibly in smaller blocks than during the war period but covering a much wider range of products.

To meet this coming demand, most of the larger power companies in Canada are either constructing plants or preparing designs ready to construct plants.

The use of the electric stove is more than ever rapidly increasing. The designs of the stove offered have not during the past year, to any extent, shown any extraordinary radical changes or new developments except in so far as continuous and increased efficient service is concerned, such as is effected by an element having a longer life, and slight modifications in structural design.

The question of the fact of an electric range load on a distribution system built for lighting is now rapidly becoming known, and to the minds of most engineers is shown by careful load survey to be very satisfactory from the viewpoint of diversity.

The average central station manager, until lately, was rather inclined to view the electric range as perhaps a good thing to have on the system in small quantities, but to a certain extent feared what the result might be in considering that apparently a large range load would mean a tremendous expenditure in lines and transformers.

Practically, however, due to the diversity, the rapid installation of the electric range has not resulted in any such conditions as at first thought. The diversity has been found to lie between the limits of 10 and about 30 per cent., and for the average system having over 100 ranges connected the diversity factor will not exceed 15 per cent. The average demand for one stove does not often exceed forty per cent.

It is the opinion of this committee that if some means could be found whereby the cost to the consumers of the stove could be considerably reduced, it would considerably increase the use of the electric stove.

Another point to be considered is that the range demand on a system seldom overlaps the lighting peak. This definite knowledge regarding the diversity factor of the range load cannot but result in the central station manager pushing the installation of electric ranges more than ever.

The question of the cost of a range forms an interesting study. There is no doubt there exists room for what might be termed the "Ford of the Electric Range Business," and if a range could be sold to the central station to-day at about $60.00, it would add a great stimulus to its use. This range would be sold to people of very moderate means, such as mechanics, factory workers, etc. There, of course, exists the need for the higher price ranges, and as time goes on we

find that amongst discriminating buyers of more extensive means the higher price ranges are easily sold and are actually in great demand.

The business of selling electric stoves is still, to a certain extent, clouded by the fact that there does not exist on the market, to our knowledge, a water heater that will give absolute satisfaction. The manufacturers of water heaters in some cases seem to have done everything that can be done to cover the situation, but there are so many difficulties to be overcome, the question of impure water being probably the most serious, and a trouble that we can hardly lay at the door of the manufacturers.

However, a heater has been designed to overcome this, known as the "Clampon" heater, in which the element is fastened dirctly to the outside of the circular hot water tank.

Synchronous Motors.

Synchronous motors are rapidly coming into popular use, and in the opinion of this committee, rightly so, as the judicious use of this type of motor both from the point of view of the power company and the consumer is a step in the right direction.

This particular type of motor is, of course, broadly, only practicable in the larger size of the motors, being perhaps more complicated from the operating point of view. However, their usefulness in this sphere of the work fills a great demand. A motor of medium size, say three to five hundred horsepower, has great value in correction of power factor on a system of fair size, where the power factor is of fairly high value, say about eighty, and we may, by this use, easily effect an improvement of at least ten per cent., thus making existing generating or transformer equipment of greater value to the power company, and proving likewise beneficial to the customer in freeing him from penalty for low power factor under the penalty clause.

The practice of making rebates on the power charge by giving a bonus or arranging a sliding scale with the customer is sometimes resorted to. For example, a range of from eighty-five to ninety per cent. power factor may be taken, below which figure the power factor penalty clause operates, and above the higher figure the customer commences to receive rebate on his power charge.

This practice is hardly to be commended, as in the average case of a contract of this nature the amounts of power are fairly large and the customer usually has miscellaneous equipment and can, in some cases, practically run his plant at unity power factor, a condition not often considered at the time of making a contract. In cases where a customer has to run, of necessity, in certain classes of manufacture, a small steam plant, it can be readily understood what possibilities such a bonusing scheme offers.

The object of the penalty clause and the use of the synchronous motor is to bring the power factor as near unity as possible, and so

make maximum use of all electrical equipment, but it is not primarily to be thought as a method of giving lower power factor rates.

While talking on the subject of synchronous motors we recommend the close attention of manufacturers to this subject, with the idea of standardizing designs and reduction of cost.

One of the difficulties met with at the present time in connection with the propositions where a fairly large amount of transmission line work is involved, the present high cost of labor and materials make the resultant rates for power much higher than previous years, and when compared by prospective users with rates of a few years ago, do not appear to them to be at all satisfactory. Unfortunately at the present time there do not appear to be signs of any great relief from this situation.

In connection with transmission of large amounts of power over fair distances high voltages are now being given serious attention by engineers, and voltages of 200 kilo-volts and more seem to be going well within the range of construction and standardization. The same remark may be said of turbine and power generating units.

It might here be mentioned that 1918 saw the completion by the Shawinigan Water & Power Company of the longest transmission span yet constructed, this being some 5,000 feet between tower centers, carrying a three phase circuit, with wires in a horizontal plane fifty feet apart.

The subject of arc furnaces does not present any great advance from that indicated in our report made last year, with the exception that a number of large size furnaces used in the manufacture of carbide and ferro-silicon are continually being added. The arc furnace field, however, has recently seen the partial developmnt of a three-phase furnace for the fixation of nitrogen, which promises well for the future.

Respectfully submitted,

R. J. BEAUMONT, Chairman.

Mr. R. J. Beaumont: I might here explain in connection with Mr. Gould's remark, that these remarks are not intended to cast any reflection on the effectiveness of the water heater. There is no doubt in our mind that the electric water heater is feasible, and the capacity of a water heater for six in a family is less than 1,000 watts.

I move the adoption of the report.

Mr. McDunnough: I second that motion.

The President: Before putting the motion I invite discussion on the part of each and all of you. I should like to hear from you.

Mr. Gould: From my experience with electric ranges I do not see why central stations, that have not done so before, do not get after that line of business. I believe that is a good line of business for central stations; the only thing that militates against it at present

is the cost of installation of a range in our Province of Ontario, where we come under the rules of the Hydro-Electric Power Commission, which are very drastic and must be observed. The cost of a range, as stated in the paper, runs from $65 up as high as $120, but the cost of the installation of the range is prohibitive in many cases to the customer, because it runs into a good deal of money, from $50 to $70, but after it is installed it is a good thing for the central station. It eats up power at a time when it is not used for other things, except a little overloading in the evening, and in the fall; it does not interfere with other business, and it is a good revenue producer. Especially at the present time when the cost of domestic coal has risen so very materially, once it is installed it is a matter of very great economy for the user. From my experience in my own house with it, I can recommend electric range business to the central station owner as a good thing for his business.

The President: That is very interesting to us all, and I would just like, in that connection, to know how the actual cost of running compares, for instance, with gas stoves.

Mr. Gould: I have never had any experience with a gas stove, because there is no gas manufactured in the town in which I live.

The President: Could you contrast electrical energy with coal?

Mr. Gould: Yes, the coal in our town costs, just now, $12.25 a ton. From my experience with the coal range, a ton of coal would do our kitchen range about 35 days, the cost being $12.25. Our cost for the operation of the range, to do all our cooking, at the rates at which we buy electricity locally from the Hydro-Electric Power Commission, does not exceed $5 a month in the summer, and about $8 in the winter. This includes the domestic lighting; it is very much cheaper than coal.

The President: Perhaps Mr. Dion would tell us something as between gas and electricity.

Mr. Pratt: I can answer your question exactly. After having my electric range for five months I looked up my gas bills; I buy gas at 45 cents a thousand feet—natural gas. Our electric light rate is 1.6c a kw. hour where customer guarantees a minimum of $2 per month, and I find that the first five months my range was in use the electric bills averaged $1.70 per month more than they did before; on comparing my gas bills I found that the gas bills were $1.70 less per month. However, I would like to say that during that five months my wife was doing our own cooking, and in making comparisons you have to consider the efficiency factor of your wife and the deficiency factor of your hired help.

The President: I suppose that the question of efficiency would operate whether gas or electric energy was used?

Mr. Pratt: Not to the same extent. I find that our electric range services are very much in excess of the gas.

The President: Of course that comparison is with natural gas. Perhaps we could hear a comparison from where gas is manufactured. Mr. Dion, are you at liberty to give us that?

Mr. Dion: I have no definite figures. We use both gas and electric, and our cooking business is very largely gas. Then we have a sliding rate there, so that it is very difficult, without an extensive inquiry, to determine how much a customer is really paying for operating his gas range. We have not a large number of electric ranges. I have no definite figures to give.

The President: I must confess a certain amount of individual surprise at finding myself constantly in the position, when people ask me how the situation lies, to find I can never give them the facts. Here we are a gathering of electrical people, and I am not yet getting this information. Doubtless we shall get it. Perhaps we have been a little laggard in getting the exact situation with reference to the difference between the cost of gas on the one side, and electricity on the other, in cooking or heating.

Mr. Beaumont: It is very difficult to get the actual comparison because the conditions are so different in different towns. With the present cost of gas and electricity in Montreal I would say that the electrical cooking is about 250 per cent. more expensive than gas. But then if you go and take Three Rivers or Quebec, on our system, and compare, for example, the Montreal gas rate with the Three Rivers or Quebec electric rate and you derive a cost, I should imagine, which would make electric cooking possibly 25 more than gas, that is with Montreal rates for gas. Electric cooking for a family of six in Montreal would be about $3.00 for gas, and $4.00 for electricity in Three Rivers or Quebec.

Mr. McDunnough: In Quebec a number of our customers state that electric cooking is cheaper than with gas. The price of gas in Quebec is $1.20; we have two different rates for electricity. We have one straight rate of 2½c kw. hour, and another rate 60 per month fixed charge for top burner plus one cent per kw. hour; we have very few complaints of high bills from our customers. In practically every case the electric range was put in and gas range was taken out.

Mr. Turley: I believe a lot of the trouble in connection with electric ranges would be eliminated if a policy something similar to that which was carried out some years ago by gas concerns in educating their customers how to use gas stoves was adopted. I understand from agents who sell electric stoves that the great fault with all the people who use them is that they have been accustomed to using gas stoves, and they start to use electric stoves in the same way. Electric stoves are very much better insulated. Take a gas stove and turn on your gas and there is a tremendous loss of heat. Electric stoves are now being constructed more on the principle of the fireless cooker, and keep their heat in. I understand the Westinghouse people are now getting out an electric cooker which has a clock on it and

thermostat which shuts off your current when it gets up to proper cooking temperature for any class of material you are trying to cook. If that is carried out I imagine gas will have a stronger competitor in electricity. In the case of gas stoves, I have run tests with a gas stove in cooking, and I have found over 50% of your heat is wasted in radiation. Now, that is due to the fact that they do not put in heavy enough insulation in constructing gas stoves, whereas in electric stoves they are doing so. Fifty per cent. of the total heat in the gas is lost in radiation, and does not go into the cooking.

Secretary Volkmann: Is it as low as that?

Mr. Turley: Yes.

Secretary Volkmann: I thought if 75% of the heat was lost it would be nearer right.

Mr. Turley: That probably would apply to top heater, but the test we ran was only on oven. We put the stove in enclosed space and measured all heat that was radiated in that closed space.

The President: Do you happen to know if those controlling arrangements are effective at all?

Mr. Turley: I could not say.

Mr. Davies: The effect of the price charged for electric cooking is about the same as the price charged for electric light. It really does not matter, within reason, how much you charge, the bill is about the same. You know electric light has been reduced from 10 to 5 cents, but the average bill remains the same. The customer uses more. A customer figures he can pay a certain amount for electric cooking, and if his bill runs above that he gets after the person who does the cooking. Generally speaking, our company have a rate of 3c per kw. hour. We serve families not very well to do, but these families can get away with bills of about $40 per annum for the average family, and they are quite happy and satisfied at the price. I have a gas stove in Montreal, and my outlay for gas is considerably over $40. I am sure if I had an electric range I would get away with the same total.

In regard to Mr. Beaumont's point he brought up in regard to diversity on stoves, that point was brought up in connection with the capacity of meter to put on the stove, and we found that a 20 ampere meter covering a 60 ampere range is quite sufficient. We do not have any trouble with 20 ampere meter at all on that size range, and figuring on 20 per cent. diversity for stoves is certainly O.K. Central stations need not be afraid of adding on electrical stoves to their lines.

Mr. Anderson: In connection with the diversity on stoves, I do not think, as Mr. Davies says there, we do not need to be afraid to put it on. I lately tested a transformer on which we had about 17 or 19 stoves, and then put on recording ammeter on each side of the transformer. The load did not go above 30 amperes on either side, with the 69 kw. connected load.

Mr. Atchison: I wonder if somebody would give some information as to how they connect circulation water heaters to the tank. That is, what is the best method, whether at the top or center of the tank, or or how?

Mr. Gould: The heater in my house was connected at the bottom of the tank, the pipe from the heater running to the top of the tank. The hot water goes in at the top. If you do not get the water heated at the top you would have to heat the whole thing before you could get anything hot.

The President: You have not come to a conclusion yourself?

Mr. Atchison: Yes, practically so. We have favored the top connection, but some people seem to be of the opinion that the center connection would be the better.

On the cost of range installation, we have made quite a study, and we very seldom exceed $25.00. We try to have the range located as close to the service entrance as possible, which cuts down the amount of wire and pipe required. We use No. 6 duplex wire and ¾" pipe on a number of installations, and this cuts down the cost quite a lot.

Mr. Gould: Where is this?

Mr. Atchison: In Quebec.

Mr. Gould: You should live in Ontario to get experience. I do not see how you could make that installation so cheaply even in Quebec. Take the box, I think the wholesale cost of it is about $11.50. We sell it to the customer for $15. The box and the cable and the conduit which have to be installed to comply with the rules in our Province will amount to more than you get for the whole of your installation in Quebec Province. I do not see how you can keep the cost of it down to $22, because the cost of the material would be more than $22 alone, irrespective of the labor.

Mr. Woodyatt: We do not have any box.

Mr. McIntyre: Wiring contractors in Hull gave a flat rate for wiring electric ranges of $7.00 complete, but I understand from Mr. Gale that he has known of some cases where they have charged as low as $2.00 for such installations.

Mr. Gould: All they need is a little rubber covered wire, about four feet on each leg.

The President: I have a sort of impression that some day, if not in the Province of Ontario, Mr. Gould will find water heated by electric energy.

Mr. Woodyatt: Speaking about the comparative cost, I think we are a little bit slow in not getting out exact figures of costs. The cost of electric cooking is one of the most consistent things I have ever run across, averaging about one kw. per person per day in a family. Of course, there are a lot of figures of costs that jump around a good deal, but this is a remarkably consistent figure and stands up very well. If we can get a figure as to the number of cubic feet

of gas used per person per day in a family we could arrive at some kind of figure there. That is not the big point. One of the biggest things that is going to send electric cooking ahead is the absence of smell, and another the convenience, and that is very pronounced. People that have changed around would not think of changing back.

Another point that does not seem to be touched on—I am not so sure of the figures, but they run something like this: I understand that a 10 lb. roast of beef cooked in a gas oven comes out weighing about 7 lbs., and the same roast in an electric oven comes out weighing 9 lbs., the 2 lbs. difference being the juices of the meat, which contain the real good. The rest of the stuff is fibre.

The President: Is there much experimentation on that?

Mr. Woodyatt: I understand there is. There is another point Mr. Davies brought out that is very interesting, about the cost of the cooking being more or less a fixed thing. I have a very good example of that in my own house in Westmount. I was the first electric cooking customer there. They experimented by giving me a rate of 3c, and our bill worked up pretty well on that; about 1 kw.h. per day per person. After that they made a couple of cuts, and finally got it down to 1½ cents per kw.h., which is not all cut, however, because it is a municipal plant, and we pay $2.50 a head for street lighting, which makes up for that, but our bill for electric cooking is now about 2 kw.h. per day per person. The simple reason being that at the 3c rate there was some care taken, and the average bill would be about so much, and when the rate was cut in two, well, nobody paid any attention, they could use it as they pleased and the bill is about the same as it was before.

The President: Does it give you great satisfaction in point of ease and that sort of thing.

Mr. Woodyatt: Yes. There is another point. On the water heater, I am in disagreement, not only with Mr. Gould, but some of the rest. I have a water heater I bought in 1910, which is run on 500 watts. The boiler is lagged; there are four people in the house, and we have all the hot water we want; in fact, many times the water is too hot to use. There seems to be a doubt whether my heater is properly rated or not, and it is going to be tested out.

Mr. Gould: Better have it tested.

Mr. Woodyatt: In connection with the water heating, I think Mr. Gould, and perhaps some of the others were arguing at cross purposes. He spoke about having to heat the top of the tank in order to get hot water. All our water heating is done on flat rates, and water heaters on all the time, so that it does not make much difference about that, hot water is always at the top, and I believe that the policy for central stations should be to discourage anything like instantaneous water heating, not only on account of the fact that it is not satisfactory, because it is not as quick as the gas, but because it puts a very large demand on central stations for a relatively small

revenue. Whereas with the flat rate, the ordinary family can certainly do all their heating with 1,000 watts, and we get a revenue of $4 a month for that. That is used in connection with double throw switch on the range.

The President: Mr. Dusenberry, we are having a discussion on the relative merits of gas and electric stoves for cooking. Perhaps you can give us something of interest on that.

Mr. Dusenberry: I do not think I can give any particular information on the relative merits of gas and electric stoves. I think pretty nearly everybody is acquainted with the merits of the electric stove. I know very little about the merits of the gas stove, as my specialty has been electric stoves. I am an absolute believer in electric stoves.

The President: You might give us the basis of your faith.

Mr. Dusenberry: I think it is on pretty well founded facts amongst electrical men, the basis of the faith of electric stoves. The principal thing is what an electric stove will do. It is electric cooking rather than the electric stove itself that we are selling these days. This involves many things. The first thing is that it is more economical in the food saved than the gas stove, due to the insulated oven and lack of current of air passing through it. It is cleaner—

The President: That percentage of saving is quite high?

Mr. Dusenberry: Well, it varies anywhere from 10 to 15 per cent. I have seen it claimed as high as 30 per cent. I think about 10 per cent. is about a pretty good average to go on. The cleanliness of electric ranges, of course, is quite obvious.

Another advantage certainly is that the heat is so well controlled in the electric stove that you can cook to greater advantage in them than you can by any other method. I believe that the time is coming when the electric stove will contain automatic apparatus whereby the oven cannot be superheated.

The President: We have heard of some already in existence.

Mr. Dusenberry: I believe the Westinghouse Company have an apparatus of that sort, but I think that it will be still further developed. Of course, they were the pioneers in this automatic control, and that will enable you to do slower and more scientific cooking than is being done at the present time. Cooking at high temperatures in some instances has a tendency to injure food. Much better results are obtained by low temperatures and a long time interval, which is perfectly possible with an electric range, and with coal range especially it is impossible. With the coal ranges they have to regulate their heat and to cook when the fire is ready.

The cost of operation is a hard thing to determine, but from what we have seen of the rates that are being quoted by the central stations in the Province of Ontario and some parts of Quebec, the cost of the operation of electric ranges to-day is slightly lower than that of the cost of gas. This difference in cost is very hard to determine, be-

cause we electrical people have not very much data on gas cooking, and I do not know that the gas companies have really put out anything of that sort that we could make comparisons with.

Pretty nearly everybody here is very familiar with the electric range, and I do not think there is any particular thing that I can add, except that electric ranges are being improved from day to day. The principal part of an electric range, of course, is the resistor, or the element. In a way, we are all more or less dependent on this wire, a nickel chromium alloy. This is only one resistor to use. The wire manufacturers are improving their product all the time, and I think this improvement in the resistor wire will give increased durability of electrical elements that go into the range.

The mechanical improvement of the ovens is going on steadily, and although the electric range is not as fast on the top elements as gas stoves are, this difference in speed is so slight that anybody in using an electric range, by anticipating five minutes what they want to do, can easily counteract any alleged swiftness of gas. Of course, many people are used to gas cooking, they turn the gas range on and it is heated immediately, but the electric range requires a few minutes to heat up.

The President: There is one disadvantage I would like to mention, and that is the possibility, or the likelihood, of failure in the supply of electricity.

Mr. Dusenberry: I can only speak personally on that matter. I have had an electric range in my house for four years, and my current is supplied by the Toronto Electric Light Company; during that four years we have never missed a meal by the failure of the current, and I think that is about the same experience that everybody else around our district has had.

The President: What occurs to me is, if you removed that objection there must be a vast field in big apartment houses which now have gas stoves throughout.

Mr. Dusenberry: There are a great many apartment houses being equipped with electric ranges and water heaters. We have some equipment in the western United States of apartments; we have one apartment I have in mind now that has 85 electric ranges in it. That is in Los Angeles. There are apartments in St. Louis —I think there is an apartment block there that has something like 124 electric ranges installed. For years we have had small apartments equipped in Winnipeg and Port Arthur, which have from 8 to 15 stoves in them. In new apartments going up in the States there have been many equipped for electric cooking. There has been great interest by the electric light companies concerned in studying the question of diversity in these electric range installations, and the results are very interesting. In apartments you get people of practically the same income, the same mode of living, so it is a very interesting place to study the load characteristics of electric ranges.

I have some curves showing an apartment house in Salt Lake City where the diversity of 20 families is something like 11 to 1.

One of the problems in connection with the sale of electric ranges has been the water heating. This has been given great attention during the last year amongst the electric light companies and the manufacturers; it has been one of the most difficult problems in electric cooking or heating. All kinds of devices have been made, to do this work efficiently. We have decided that the thermal storage system is the best system so far devised. Of course, a water heater can be made to give you instantaneous heating, if the central station will stand for an intermittent load that will go on and off. It would not be a profitable load. The manufacturers have paid more attention to the storage system than they have to the system of giving an immediate service. There are three or four types of heaters that have been designed, the principal one is the outside circulation type heater. The advantage of this style heater is that by connecting the heater to the tank the water can be drawn from the top of the tank before the whole tank has heated up. Another design of the same style is the interior circulation system. The interior circulation system is very similar to the outside circulation system, with the exception that a special tank is used and the heater is inserted into the tank from the bottom, around the heater is another enclosed pipe that protects the water heater from the cold water at the bottom of the tank, and the water circulates through this enclosing pipe up to the top of the tank. This involves the use of a special tank, and is very convenient in the case of new buildings. The tank does not cost very much more than the ordinary tanks. Then there is the immersion heater whereby it is necessary to heat the water of the whole tank before you get the full degree of benefit from the heater. There has been lately designed another type, which is known as the "Clamp on" type. This is a heater that is built to wrap around the tank and thereby avoid the use of pipes and the employment of a plumber. It is a great saving in installation. It has been very successful in its operation. These heaters are new in Canada, but they have been tried out for a long time in the States, but they are now coming on the market here. They are made of what is known as sheathed wire. That is a wire that has the resistor put inside of an iron tube. And the iron tube you insulate from the resistor wire by an insulating powder that is packed between the sheath and the resistor so that it insulates the wire entirely from the sheathing, and then this sheathing is clamped right around the outside of the tank. This class of heater is specially adaptable to places where they have trouble with the precipitation of salts on the hot surfaces of the heater, and thoroughly avoids this trouble. It also can be clamped on any tank and can be properly insulated from the outside, by simply putting a certain amount of asbestos felt and then putting on the ordinary hair felt. This is a great improvement. All the heaters we now build can be provided

with automatic control. The automatic control governs the temperature of the water in the tank at about 180 degrees; above this heat the current is cut off. This has been worked out into a thoroughly practical device.

Mr. Haskell: I noticed there was one point that has not been mentioned. Mention was made that the high price of ranges is keeping the public from installing them. Our merchandising department, headed by Mr. Atchison, has been very successful in using a two plate cooker, which is rather a cheap proposition, with a little portable oven to be used on top, as an entering wedge. When once these are installed and used, the lady of the house will not go back to any other method of cooking, and she will, some way, persuade her husband to put in a larger range when she has demonstrated to him that she cannot do the necessary cooking on the small two plate cooker. I do not mean to give any intimation to the manufacturers that their work is over. It is up to them to reduce the cost of the ranges, but in the meantime installations can be made with the two plate cooker.

Mr. Beaumont: I would like to say here in connection with our report, when we talk about the question of price of ranges, we are not objecting so much to the price of the range, because there is a big demand for the ranges as they are at present. We can sell conveniently the highest priced range.

The President: You would want a simplified one?

Mr. Beaumont: Yes, so that we can get into the field that Mr. Haskell has talked of. Of course, you can get around that by extending the time of payments. In Three Rivers we installed over 32 electric ranges last month.

The President: I might say, gentlemen, that it has been a great surprise to me up to date that there has not been a greater adoption of the electric stove.

Anything further to be said by anyone on the subject?

Mr. Turley: One thing I would mention in connection with the Westinghouse range which they advertise. They say it will be possible, when they get this out, for the housewife to prepare breakfast the night before and set an alarm clock at the time breakfast is to be had and it will be cooked when required.

The President: Any further discussion on this paper? If there is not I will put it to the meeting. It has been moved and seconded that the report be adopted. (Carried.)

The Secretary-Treasurer has one or two things which he wishes to say to the convention, which I think, on reflection, he will say tomorrow rather than this afternoon.

There are one or two things I just want to say; they will only take a moment, but I think I should perhaps mention them. The minutes of the last meeting, that is, the last open meeting of the Association, and not of the Executive—I have not got them here written out to submit to you, but, with your permission, we will

enter upon the minutes of this present meeting, that those minutes, that is to say, the minutes of last year, have been confirmed and adopted. If that is your wish, will you kindly say "Aye." (Carried.)

Now, with regard to the papers. To-morrow, you will see, we meet at 10.30, and we are to have two exceedingly interesting papers, one written by Mr. Clark—although I am afraid you will not have the pleasure of hearing him read it—and another by Mr. Fredericks, who is going to give us a paper on the subject, "Service at Cost." I would therefore urge all who are here this afternoon to be on hand to-morrow morning. The meeting commences at 10.30.

As to the dinner; may I express the hope that all who can possibly be there will be there. Our pleasure will not be marred by any great volume of speaking, or anything of that sort, so that it will be just a matter of eating and drinking and being merry together.

The meeting is now adjourned.

Saturday, June 28, 1919.

On resuming at 10.30 a.m.

The President: There are one or two things I want to mention in advance of the items on the programme as you have it before you.

I want to direct your attention first of all to Article 18, which provides at the Annual Convention the members shall decide what special committees, if any, shall be appointed for the ensuing term. I do not mean to say they decide on the personnel of the various committees. The convention itself is not concerned with that. All we decide is what special committees shall be appointed and, if it is agreeable to you, it seems to me you might decide on having these special committees which we had last year, and had before that period also, unless there is some additional one that any member would care to suggest. Apparently we are in agreement as to that, but if by chance it occurs to anybody—

Mr. Davies: Do you want a suggestion as to committees now?

The President: Not as to personnel.

Mr. Davies: As to committee?

The President: Yes, if anybody wants to suggest any other committee.

Mr. Davies: I would like to suggest that we get back on to the commercial and accounting end again. This part of our activities has been neglected for a couple of years, and there are a lot of our fellow members, members of the companies, who could be brought into closer touch with the Association by opening this branch again. A commercial committee that would clear up points on meter reading and accounting generally.

The President: Would you kindly move that?

Mr. Davies: Yes, I would be glad to.

The President: We can name the members afterwards. Do you move that such a committee be amongst the special committees?

Mr. Davies: Yes.

Mr. McDunnough: I would second that. (Carried.)

The President: Then there is another matter I wish to mention; that is, by Article 14 it is provided that at the convention the Association, sitting as a whole, shall, by vote taken by ballot, select the place of the next annual convention, or by motion refer it to the decision of the Managing Committee. If agreeable to you, I would suggest that we adopt the latter alternative of those two, that is, that the matter be left in the hands of the Managing Committee to select the place. There are very good reasons for doing that (there may be some arguments the other way) during the year particular reasons may indicate the selection of some one place rather than another, and so far as the point of time also is concerned, I think there is advantage in adopting the latter course. Of course a debate upon the subject of where to hold meeting is likely to take some time, but, if there is a serious feeling that it should be done, we shall have to do it. My suggestion, however, is that we adopt this alternative, that by motion we refer this decision to the Managing Committee. As you know, the Managing Committee will take pains to get the views of the members by correspondence.

Mr. Haskell: I take pleasure in moving that.

Mr. Schwegler: I second that. (Carried.)

Mr. McDunnough: Is this the time to bring up matter of Meter Committee along the lines that were suggested yesterday—that is, sort of a meter clearing house, or is that a matter to be left to the regular standing Meter Committee to organize, because I think that suggestion in that paper was very, very good and should be carried out.

The President: I think so as to make it beyond question you had better make that a motion.

Mr. McDunnough: I will move that.

Mr. Davies: I second that. (Carried.)

The President: This morning the first item on the programme is a paper on "Oxygen and Hydrogen, a New Source of Revenue for the Central Station," which has been prepared by Mr. Farley G. Clark, Chief Engineer, Toronto Power Company. I regret to say he has found it quite impossible to be here, but Mr. Volkmann will read the paper for him. Mr. Volkmann wishes in advance to mention one or two matters which yesterday I told you he had decided to postpone from yesterday until this morning.

Secretary Volkmann: In connection with my work as Secretary-Treasurer of this Association during the past year I would like to get, if possible, an expression of opinion from the members of the Association. I find it very difficult, for instance, in sending out questionnaires to the member companies, to get a response from probably more than

five or ten per cent. of the members. This is the point that I wish to bring out: Are the activities covered by our present standing committees really the ones that the Association want? Are there any other activities that we can embark on that will bring our members closer together and improve the standing of the Association? I know that in the past three or four years, due to war activities in Canada, it has been hard for many of the members to devote much time to the Association, but now when many of the men are returning and organizations are building up, I think that we at the same time should build up our activities. For the benefit of the Executive and Managing Committee during the coming year, if any of you here have suggestions in the line of activities that you think would tend to build up the Association, and which would be of benefit to the privately owned public utilities and our other members, I think it only fair to yourselves and to the Association that you suggest it; then during the coming year if there is anything that comes to your mind that you feel is of interest to, or would be of benefit to, the Association, we would be only too glad to hear from you. If your Executive and Managing Committee do not have the confidence and suggestions of our members, we do not know whether we are accomplishing the things we are supposed to be accomplishing or not, since it is only through the cooperation of all of our members that we really get the benefit of the ideas of all of them.

There is another point that I wish to bring out—most of the papers in the past have been of the nature of historical papers, covering developments during the past year. I myself feel that if the Association wants to be really progressive they should do more constructive work. I certainly feel, after watching the progress of the Association during the past year, that the thing most necessary to bring the Association to the front, if we are to be really representative of the private public utility companies, is constructive work. We now have a good chance to come to the front, in the preparation of standards, or things of that kind. The Canadian Engineering Standards Association has been formed, and I do not see why the Canadian Electrical Association should not be the proposer of various standards to be put up to that committee to act upon. I do not see why we should not do this rather than have the municipally-owned systems and some of the others start the ball a-rolling. If we can get in on the ground floor, the things that we suggest will likely carry the most weight and in the end be adopted. If any of you have any suggestions, I can assure you the Executive would be only too glad to hear from you.

The President: I might say, in case any member feels that he would like to think that over, that there will be every opportunity to get suggestions into the hands of any member of the Executive, which may be taken up this afternoon at the session or at the end of this meeting this morning, if you will.

Secretary Volkmann: I had hoped that Mr. Clark would be able to be with us here to read this paper, but due to unforeseen circumstances he was not able to attend, and so commissioned me to present it. I have been interested to a certain extent in the preparation of it, but I do not feel that I will be Mr. Clark's equivalent in answering any questions that might come up in the discussion.

OXYGEN AND HYDROGEN A NEW SOURCE OF REVENUE FOR THE CENTRAL STATION.

F. G. Clark, Chief Engineer, Toronto Power Company.

On the assumption that a diversity of loads is the first requisite of a central station, the next would be a high ratio between the average load and the peak load. The attainment of a high load factor with diverse types of loads is one of the main problems of central station management.

It is not my purpose to discuss this problem, but to set before you the facts relating to one specific proposition capable of smoothing out the rough curve of a variable load, and of filling the valleys between the peaks of the load at the generating plant. The electrolytic cell suggested for this purpose, functions with respect to power supply the same as a storage battery on charge, and so long as its input rate equals the load variations, can be made to regulate just as well as the battery. The cells may be so controlled as to follow the rise and fall of a peak so that approximately 100% load factor may be maintained upon the generating plant if that is desired.

The value of regulation of the load curve is well understood by central station managers, but increasing the load factor introduces many complications, most of which are peculiar to each particular system, and must be separately considered. I will not attempt a general discussion of these matters, but shall refer to one phase of the question which can be viewed in a new light, the supply of power to street and interurban railways, and the electrified sections of steam railroads. Neglecting, for the moment, the last mentioned, we find that whereas a decade ago practically all electric railways generated their own power, often at excessive cost, and due in part to their very low load factor, they are, to an increasing extent, becoming customers of the central station companies. The central station sells three phase, alternating current to the railway in bulk, and the railway converts and distributes it from its sub-stations. An annual load factor of 30%, and a daily load factor of 40% is about the average for street railways. Mingled with the diverse loads of a central station, these factors may be equated to 40% annual and 50% daily, but this is about the best that can be done. Storage batteries would benefit the load factor, but cannot be considered in this connection, by reason of their 60% efficiency and the fixed charges.

Electrolytic cells of the type here considered have been designed

with especial reference to operation where the electrical input is variable and subject to rapid and violent fluctuations.

The thermal efficiency of the cells previously used varies from 65% to 75%, with current flowing at the rate of .1 ampere per sq. in. of diaphragm surface between electrodes. That of the new cell varies from 60% to 80%, with current varying from .5 to 4 amp. per sq. in. of diaphragm surface between electrodes.

The usual method of expressing cell efficiency is to ratio the actual voltage per cell with the decomposition voltage of water between platinum electrodes. This is not a true measure of efficiency, but upon this basis present cells with .1 amp. per sq. in. operate at 80% to 85% efficiency, and with 1. amp. per sq. in. at 40% to 60% efficiency. The new cell gives the following efficiency:

At .1 amp. per sq. in.	95%
" 1. " " " "	89%
" 2. " " " "	80%
" 4. " " " "	60%

The installation costs of large-sized plants equipped with existing types of cells, including building, but exclusive of electrical generating or converting apparatus and compressors, will not be less than $750 per kw. of electrical input, and will generally exceed $1,000 per kw.

The installation costs of the new cells, including building, but exclusive of electrical apparatus and compressors, will, for similar plants, be approximately $50 per kw. of the normal electrical input.

The efficiency of the new cell at its normal rating is about the same as that of the present cells, which is 80% referred to platinum electrode decomposition, or 30% thermal. By decreasing the current rate per unit of diaphragm to the normal rate of existing cells, the efficiency increases, and by increasing the current rate to double the normal rate, the efficiency drops to 60% dissociation or 25% thermal. The new cells may be operated at this high rate, though it must be understood that the cost of electrode and diaphragm renewals must be taken into consideration. Operation at twice the normal rate reduces the installation costs per kw. input by one-half.

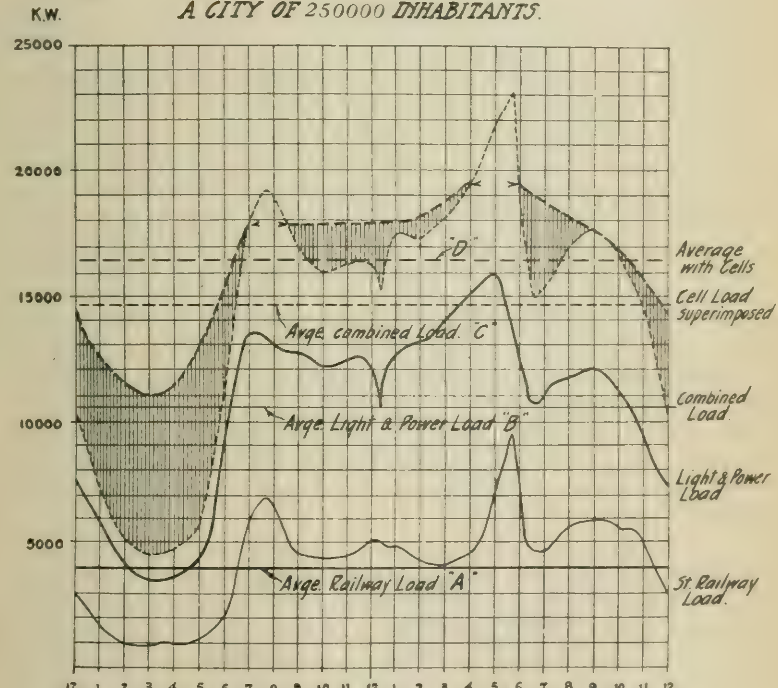
We may assume that the maintenance costs on cells and building is, for existing cells, 2% per annum. The maintenance costs of the new cells depend upon the gas output, although skill in operating the cells has a bearing upon these costs. The results of two years of operation indicate the following:—

	Percentage of total cost for maintenance and renewals.
When average rate is .5 amp. sq. in.	3%
" " " " 1. " " "	5%
" " " " 2. " " "	8%
" " " " 3. " " "	13%
" " " " 4. " " "	20%

Interest, depreciation or amortization and taxes are taken at 10 .

The attached sketch has been prepared to indicate the typical loads of a city of about 250,000 inhabitants.

ILLUSTRATING THE USE OF 3000 K.W. OF ELECTROLYTIC CELLS ON COMBINED ELECTRIC LOAD OF A CITY OF 250000 INHABITANTS.



Load Factors:-"A" 42%. "B" 65%. "C" 60% "D" 72%.

The railway company generating its own power, would require 4-3,000 kw. units. The electric light and power company, for its own uses, would require 4-5,000 kw. units, but if it were to supply power to the railway company, one additional 10,000 kw. unit would be needed. It may be taken as an accepted fact that the railway company's load can be furnished more cheaply by the power company than it can be generated in its own plant, so that the carrying charges

of the railway plant are probably the determining factor in the arranging for a sale of power by the power company.

Looking at the railway curve, you will see that it might be possible for the power company to sell the railway requirements up to 7,000 kw., in which event their own plant would be in use only a few hours per day. It is doubtful, however, if this would produce any net saving over the purchase of all the power required. I might suggest that if hydro-electric power were being considered, then the steam generating plants would not be required except as stand-by reserves, or to carry the seasonal daily peaks.

While these and many other considerations have a bearing upon the question of purchase by a railway company, and sale by a power company of power for railway operation, it may well be some other factor that will turn the scale into a profitable undertaking for both parties, and my somewhat lengthy preamble brings us to this point.

It is a well-known fact that the kw.hrs. generated in a plant do not cost alike. The peak kw.h. cost the most, and the off-peak or night kw.h. the least. If the load curve were a straight horizontal line, each kw.h. would cost the same as every other one; but even in this case, unless all of the kw.hrs. were used in the same way, their value for sale would not be equal. Let us suppose, for example, that the power company was able to sell to a user of power those kw.hrs. shown on the sketch as the cross hatched area. The effect of this would be to raise the load factor from 60 to 72%, and in doing this the power company would hold control of the power delivery at all times. These kw.hrs. certainly do not cost the power company anything for generating capacity, and, if supplied to the railway company, nothing for transmission capacity. The cost, therefore, will be the coal, labor and maintenance costs attributable to those particular kw.hrs.

It is a well known fact that the operating cost of the kw.hrs. generated between 1 and 5 a.m., because of the low load on the plant, is greater than for the kw.hrs. on peak, so that if the night valley be filled up the extra kw.hrs. should not carry any fixed charges, and their total cost should approximate the operating cost of the peak kw.hrs. As a matter of fact it can be proved that they cost less.

Let us see how this works out by referring again to the sketch:

	Peak.		Average.		Total.		Load Factor.
Railway load	9,500	kw.	4,000	kw.	96,000	kw.h.	42%
Light and power load	16,000	"	10,500	"	252,000	"	65%
Combined load	23,000	"	14,500	"	348,000	"	60%
Adding cell load ...	23,000	"	16,500	"	396,000	"	72%

With coal at $4.00 per ton net, and labor at 1919 rates:

	Fixed Cost.	Operating Cost.	Total Cost.
Railway load	$.0030	$.015	$.0180
Light and Power load	.0024	.010	.0124
(a) Combined load	.0020	.009	.0110
(b) Total load	.0020	.0075	.0095

(a) The fixed charge of the railway steam plant not included.
(b) No additional plant required.

It appears that the off peak power superimposed upon the plant costs $.0075 per kw.hr. If this off peak power can be so used that it will net the power company $.0075 per kw.h. they can afford to sell to the railway at $.01 per kw.h. As a matter of fact the sale would probably be at so much per kw. of peak per month or year, with an energy charge for the actual energy taken, producing in a year a return equivalent to one cent per kw.h.

It is suggested that the power company shall sell d.c. instead of a.c. power to the railway company, and take over the sub-stations for this purpose, charging for the d.c. power the equivalent of 1.25 cents per kw.h. to cover fixed charges and losses.

Having these sub-stations in charge, the power company should install electrolytic cells and operate them from the d.c. buses as off peak power users and regulators of load on the generating stations.

Let us assume that there are four sub-stations, each of 3,000 kw. capacity, and that in each the following cell installation is made:—

1 electrolytic battery, 1,000 kw. normal.
1 oxygen compressor.
1 hydrogen compressor.
1 water still.
Fixed tanks, spare parts, etc.
3 installations, $150,000.

These cells will average 66 of the normal rate, but will at times be operating at nearly twice the normal rate.

The costs per day would be:—

Fixed charges on cost at 10%	$ 41.00
Maintenance at 8%	33.00
Labor and materials	60.00
Power	435.00
	$569.00

The gas manufactured per day would be:—

99.5% pure hydrogen	336,000 cu. ft.
99% pure oxygen	168,000 cu. ft.

Cost of both gases, $1.129 per 1,000 cu. ft.

Liquid air oxygen 97% pure costs $2.00 per 1,000 cu. ft., and at 1,800 lbs. pressure, in cylinders, sells at from $12.00 to $20.00 per 1,000 cu. ft.

Electrolytic oxygen, when impure, contains hydrogen, a heating gas, giving out over 300 heat units per cu. ft. when burned in the air. When oxygen is used for welding or cutting, 3 or 4 per cent. of hydrogen is not a disadvantage, and simply results in less oxygen per unit of holder capacity. Hydrogen as an impurity in oxygen, beyond 10 per cent., produces a mixture which tends to become explosive, and becomes more dangerous as the hydrogen content exceeds 10% of the volume.

Liquid air oxygen, on the other hand, contains nitrogen, an inert gas, as its impurity, and this impurity is seldom found less than 3 per cent. Although this impurity tends to render the oxygen more and more safe to handle as its content increases, it renders the oxygen less and less valuable in much greater proportion. Exhaustive tests in welding and cutting with the oxy-acetylene torch indicate that oxygen gas containing two per cent. of hydrogen is 20 per cent. better than oxygen gas containing two per cent. of nitrogen.

When both gases, or rather the total gas, costs $1.129 per 1,000 cu. ft. the oxygen alone will cost $3.39 per 1,000 cu. ft. In that case the hydrogen is free, and can be sold for any price that will cover the expenses of sale.

The present use of oxygen gas in the U.S. alone exceeds 5,000,000 cubic feet per day, or 1 cu. ft. per 20 inhabitants. If the use were uniformly distributed according to population, a city of 250,000 people would require 12,500 cu. ft. per day. The use of oxygen is confined to manufacturing towns and cities, and particularly to those engaged in certain lines of manufacture.

The requirement of a city of 250,000 may not exceed 12,500 cu. ft., and it may be in excess of 500,000 cu. ft. per day. A canvass of the manufacturing establishments will soon disclose the actual needs, and the use of oxygen will increase as its cost decreases.

Hydrogen can be used for welding light iron or steel, and to a limited extent in the welding of other metals. In the oxy-hydrogen torch it is an excellent cutting agent, and when a great deal of cutting is necessary, as in a steel fabricating plant or a shipyard, should replace the oxy-acetylene torch for this purpose.

There are a number of present uses for hydrogen, and its future in the arts is an array of possibilities almost staggering the imagination. It is used in the hardening of oils and fats as in soap works. It is used in glass blowing as a heating agent. It is used in the laboratories of manufacturing plants and colleges as a reducing agent.

All of the above uses are predicated upon hydrogen at a cost of from fifty cents to two dollars per 1,000 cu. ft.

If the plant we have been considering were treating hydrogen as the product and oxygen the by-product, the cost of hydrogen would be $1.69 per 1,000 cu. ft.

When both gases are saleable products to the capacity of the plant, their respective costs should be based upon the relative values of the two gases, in which event oxygen would always be worth at least twice as much as hydrogen, and the costs would be, for oxygen $1.68 and for hydrogen 84 cents per 1,000 cu. ft.

A company manufacturing oxygen, with hydrogen as a by-product, may dispose of the hydrogen in bulk in two ways, reserving the privilege of withdrawing any portion that can be sold at higher prices to manufacturers who can use it in their processes.

Hydrogen burns in the air to form water, and for every 1,000. cu. ft. of hydrogen this consumed, 305,000 heat units are liberated.

The heat standard for illuminating gas is 585,000 heat units per 1,000 cu. ft., and this gas is made by the retort or water gas process. Coal gas, as usually made, will absorb from 5 to 15 of hydrogen, without lowering its heat value below standard. Water gas, when burned, liberates 308,000 heat units per 1,000 cu. ft., and at present costs for coal and labor in a plant supplying a city of 250,000, can be made for from 15 to 20 cents per 1,000 cu. ft. We may, therefore, take 15 cents per 1,000 cu. ft. as the value of hydrogen gas, delivered to a gas company.

Hydrogen gas may be used as a heating fuel, and be burned under boilers or replace gas in the heating appliances of manufacturers, or, by suitable changes in existing apparatus, be burned in retorts and circulated through the heating coils or radiators of the heating system of a building. The hydrogen must economically replace coal or gas when used as a heating agent.

When 600 b.t.u. gas is used, the hydrogen has a value one-half that of the gas.

Where coal is used, the situation is complicated by considerations of space and labor saved, coal and ash handling eliminated, general cleanliness, and where soft coal is used, freedom from smoke.

I consider that the gas has a minimum value of twelve cents per 1,000 cu. ft. where hard coal, costing $10.00 per ton net, is used, and a value of seven cents per 1,000 cu. ft. when soft coal, costing $4.00 per net ton, is used.

The price for use in heating buildings will depend largely upon the results obtained and the value held by the purchaser of the many factors having a bearing. In connection with a lighting and power contract and the replacing of an isolated lighting and heating plant, the gas may have a value of forty cents or more per 1,000 cu. ft.

Work is in progress relating to the development of processes for the production of large quantities of hydrogen, based upon the electrolytic cell and the use of larger quantities of hydrogen in the production of standard marketable products. The work has advanced

to a point where I am warranted in asserting that the electrolytic production of the gases oxygen and hydrogen will shortly be of considerable import to industry in general.

In a statement of this kind which must necessarily be concise, I can do no more than hint at the possibilities, as much of the work we and others are doing along the lines of research and development have not yet reached the final or commercial stage. I can only suggest that the prospects are very good for the announcement of one revolutionary proposition in the near future.

The foundations of the revolutionary change are the gases oxygen and hydrogen, and the keystone of the arch is the electrolytic cell.

The Toronto Power Company is preparing a bulletin containing full information regarding the cells, and detailed information will be given to those interested. I might add that the Toronto Power Co. operates one of the hydraulic plants on the Canadian side at Niagara Falls, and a steam plant at Toronto. The combined peak load capacity of its plants is 185,000 h.p. In 1915 the company established a research department, having for its purpose, among other things, the increasing of the load factor of its system, and incidentally of its revenue.

Finding that the manufacture of the gases oxygen and hydrogen by the electrolysis of water was a promising proposition and that there was no apparatus on the market suitable for use on a large scale, having regard to the economic features, the research work was at first concentrated upon the development of a type of cell which would meet the requirements.

The result of this development is a type of electrode construction permitting operation at high current densities and high temperature. Cells of this design have been in operation at the company's Toronto plant for over two years, having in this time fully demonstrated their commercial practicability.

The value of the electrolysis of water to the Toronto Power Co. will consist of the sale of oxygen and hydrogen at prices sufficient to cover the costs and carry a reasonable charge for the electric power used by the cells. As the company has an annual load factor of 50% the possibilities are tremendous, providing there is a market for the gases. There is idle potentiality for the manufacture of one billion cubic feet of oxygen and two billion cubic feet of hydrogen annually. This is more than the annual use of oxygen in the U.S. and Canada. and many times the annual use of hydrogen.

Transportation costs limit the radius of economic supply from a central plant, and this disadvantage increases as the price of the gas at the point of use decreases, so that both gases would have to be used at or near the point of manufacture. This company contemplates using the gases in manufacturing processes, which also have been developed by its research department, and information regarding which will be given out from time to time.

The President: After listening to that interesting paper read by Mr. Volkmann, I invite discussion by any who care to discuss it, but I am sorry to say this morning I have to suggest to any who discuss it, that they be as brief as they can be, because I cannot stretch the time, and we have not very much of it at our disposal. If, however, there are any points which any would like to bring out, I hope they will do so now.

If there are any questions upon the paper which any member would like to put to Mr. Volkmann, he will be glad to answer them.

Mr. Kaelin: I wish to thank Mr. Clark and Mr. Volkmann very much for this very interesting paper. I am very much interested in this cell, and our company has to some extent been interested in the same line. We have a research department which is doing work in a similar direction in connection with our chemical industries, not so much from the standpoint of using power for improving the load factor but much more in using power in general for new industries, and to extend our chemical processes. One of the greatest troubles in this connection is to make use of hydrogen when you want only oxygen. It will be quite a problem for the research department to find uses for hydrogen, but I believe the time will come, especially in synthetic chemical industries, to make use of the hydrogen in connection with hydro-carbons or other organic combinations to use up hydrogen. This is something we are working on now.

I made some enquiries some time ago regarding cells, and I really did not get much satisfaction. I found there were mainly two cells in operation in the United States, and I believe you may be interested to know more about the construction of the cells. In one type of cell the container forms one electrode and the other electrode is enclosed inside. Another construction is based on having both electrodes inside, separated by diaphragms, of course. One of the main troubles in the past has been to keep the cells in continuous operation. The diaphragms gave trouble and it is difficult to make the cells tight.

Secretary Volkmann: That is one of the hardest things?

Mr. Kaelin: Yes. I have been under the impression that the cost of hydrogen and oxygen would be much more than you mention in your paper. I don't know on which power cost you estimate?

Secretary Volkmann: That is on basis of about $49 per H.P. year.

Mr. Kaelin: Did you consider how much you pay at the present time for oxygen in bottles? A bottle is sold for about $1.50 a hundred cubic feet.

Secretary Volkmann: They are getting it cheap.

Mr. Kaelin: I have no figures of my own, but from figures obtained from manufacturers I found especially if you had to compress your gas, and sell it in bottles, the cost increased very much, because the investment in new bottles is just as much as the whole plant. At the present time you could not get any bottles at all.

Therefore it was almost impossible to produce gas, if you cannot use it right on the premises.

You speak about hydrogen costing about 56c a thousand cubic feet, which I consider extremely cheap, so cheap that I thought perhaps you meant one hundred cubic feet.

Secretary Volkmann: No.

Mr. Kaelin: I am not quite sure about amount of hydrogen allowed in oxygen to make it safe. There have been cases of explosions in some places in the West, where oxygen bottles exploded because they contained one per cent. hydrogen. I am not quite sure, but I think the limit of 10 that you speak of, of hydrogen in oxygen is getting very dangerous.

Secretary Volkmann: There have been some tests made by the United States Bureau of Mines to determine the hydrogen content at which it really becomes dangerous. If you keep your hydrogen content very low you will not have any trouble with it. In the oxygen we are making for the market we attempt to have a purity of over 99 .

Mr. Kaelin: Of course this process has to compete with the liquid air process. The liquid air producers claim they can produce cheaper oxygen by their process, but I think it depends very much on the kind of machinery, and kind of help, because the liquid air machine is a very complicated affair, and they have some trouble, I understand, in their rectifying apparatus, which some times blow up. Probably their apparatus is cheaper at the present time, perhaps not with your cell, but with the old type of cell. I am not so sure about the cost, they either cost more and they take less power or the other way.

Secretary Volkmann: It takes less power.

Mr. Kaelin: Of course they can only use the oxygen, the nitrogen has no value at all practically, at the present time, except in special cases. Is this paper to be published?

Secretary Volkmann: It will be printed in the proceedings.

Mr. Kaelin: Because I am very much interested in it.

Secretary Volkmann: I will be very glad to see that you get a copy.

The President: Are there any other members who wish to discuss this paper?

Mr. Beaumont: I would like to ask Mr. Volkmann whether they consider this manufacturing of oxygen as a problem to be undertaken by the power company properly? I mean, do you propose that a power company that wishes to improve its load factor go into the manufacturing process itself?

Secretary Volkmann: Do you mean going into the manufacturing processes for utilizing oxygen and hydrogen?

Mr. Beaumont: No.

Secretary Volkmann: Manufacturing of the gases for sale?

Mr. Beaumont: Yes.

Secretary Volkmann: Yes, that is the proposition, to produce the gases for sale around your own locality, since it is best to sell them in the locality where they are made if you have a market for them, because under any other condition the transportation problem becomes a more serious item.

Mr. Beaumont: I am of the opinion that you will find the thing to a certain extent difficult as time goes on, because if the power companies go into that business and find it successful, they, instead of being in the power business, will be in the business of manufacturing oxygen, and I can easily imagine conditions where it will be found in some cases necessary to install generating equipment for the manufacture of oxygen. I think the solution of the problem is to either discover suitable industries and sell power to them, or if it is thought the solution is manufacturing, for instance, oxygen, why it should be carried out separately and distinct from the power business, because there are so many complicated problems arising in the two types of industry. For instance, in the power business conditions are pretty well known, and a certain growth of load can be depended upon, whereas in the manufacturing industry it is subject to trade cycles. Some years will be years of rapid growth of production and extension to plant to meet the demands of the market, and other years will be lean years with production very low, perhaps at 25% capacity, and the business has got to be carried through these periods, extending over a year or perhaps longer. In some processes it would mean that the plant would be shut down for a period. In conclusion, I would say I think the industry is hardly one for a purely power company to enter into—only as an absolute and distinct business. That is, separate in every way as to management and capitalization.

Secretary Volkmann: It would probably be a good idea, of course dependent on the size of the company and size of the staff, to have it as a subsidiary or separate company, because the selling end of it is by far the biggest end of it. You must have a sales organization to handle it unless you are selling all of your output to one large customer.

I do not believe there is any particular question that you asked, Mr. Kaelin?

Mr. Kaelin: No, I am most interested in the type of cell.

Secretary Volkmann: The cell is of the filter-press type, not the pot type cell.

Mr. Kaelin: Are you going to handle the sale of the cell?

Secretary Volkmann: Yes, but not as Toronto Power Company. It will be a separate proposition.

Mr. Davies: As this is an electrical convention, I would like to mention something I heard just the other day regarding this proposition, about polarization of these cells. I understand there have been several severe accidents in the United States due to the fact that

there is a back e.m.f. from the oxygen and hydrogen cells after dis-association. The result is that after shutting down or interruption of a.c. supply to the motor generator set, the d.c. side may be magnetized in the wrong direction, when you come up again, and hence the electrolysis is reversed, and you introduce hydrogen into the tanks with oxygen, forming an explosive mixture. Up to the present time there has been no reverse current d.c. relay developed which will cut out the d.c. side of the set automatically. I understand it is an extreme hazard and has caused a considerable loss of life in several instances in the United States.

Secretary Volkmann: I have heard of several instances of that kind. There is a hazard, no doubt. There is probably just as big a hazard when you have an interruption in your a.c. power supply in having a rotary come in reversed and some operator tries to parallel it on bus bar. That is a question of supervision. We can all find exceptions if we are looking for them. This is one of the things which you have to take care of in operation. This can be taken care of very easily in the ordinary sub-station, where, of course, it would be under the control of the station operators. In the small industrial plant it would be necessary to have competent operators to look after the apparatus.

The President: Are there any other questions or any other remarks which any other members would like to make? We should like to hear from them if there are.

If there is nothing further to be said on the subject, I feel I am expressing the thought of the members here this morning when I state that the paper is one of exceedingly great interest, and the difference of view, quite clearly exhibited, shows the desirability of having such a matter dealt with in this way, because it gives us an opportunity to think over the matter and to really consider the pros and cons of it.

It was an exceedingly nice act on the part of Mr. Clark to prepare this paper for us, and it will give me a great deal of pleasure to put a resolution of thanks to Mr. Clark. As this is not a report from a committee, but is of a different type from anything you have had so far, I shall be glad to present a resolution if some members will be kind enough to move and second one.

Mr. Dion: It gives me very much pleasure to move such a resolution, that the thanks of this Association be tendered to Mr. Clark for his very interesting paper along new and inspiring lines.

Mr. Woodyatt: I have pleasure in seconding that.

The President: It has been moved and seconded, and speaking from the standpoint of Toronto, it is a great pleasure to me to say that it is moved by Ottawa and seconded by Montreal, that the thanks of this Association be conveyed to Mr. Clark, and also to Mr. Volkmann.

The next item on the programme is an interesting paper which Mr. Fredericks has been kind enough to say that he will read to us, the

paper being on the subject "Service at Cost," and I now take pleasure in calling on Mr. Fredericks.

SERVICE AT COST.

Ernest P. Fredericks: Mr. President and Gentlemen, I am very happy to be with you here, and it is unfortunate for the subject, although perhaps fortunate for you, that the time is so limited in which to present the subject. It is a very broad consideration, and it is a subject destined very shortly to occur very frequently in the affairs of public utilities—and when I speak of public utilities, I want to cover the field of light, heat, power and transportation.

In looking over the condition of most of our public utilities at the present time, I am reminded of the young man who believed he had an invariable system of beating the races, and he was so enthusiastic about it and so convincing that he induced friends of his to invest $5,000 in the plan so as to go down to the races and try it out. And he finally got the $5,000 and went down and was gone about two days and he wired back and said: "Things have been working bad. Lost everything; am broke. How shall I act?" And his friend wired back, "Act broke." It is very much the condition of some of our public utilities. It also reminds me of the time when former Secretary McAdoo was threatening to resign as railway head of the States here and he was considerably concerned as to what the future of the tremendous transportation system would be. The question was frequently asked, "Who will carry out Mr. McAdoo's policy?" One member of Congress said that he did not care who carried it out as long as nobody brought it back. (Laughter.)

The matter of Service at Cost has been tried out perhaps more in the case of our street railways than any other branch of public utilities, and yet there is a growing tendency to apply fundamental principles to all public utilities, and rather than to theorize on that phase of the case I have brought with me an actual workable franchise which is now in existence, one of our largest in the United States; it is applied to light, heat and power. I think it would be more practicable to cite that as an instance than to merely theorize or suppose what might be done under given circumstances.

Just to touch the high spots of Service at Cost. In the first place, it contemplates wages, coal, taxes, maintenance, depreciation and replacement and fair interest return on the capital invested. Those items added together constitute cost, and the charge to the consumers is predicated upon that cost. It is well to bear in mind that Service at Cost does take into consideration a fair interest return on the capital invested. That varies in various places. The average return is figured at 6 , although there are instances where it should run considerably higher. I have heard it said, and I think with a great deal of justness and truth, that a stockholder or shareholder in public utility would rather get 6 and get it than to get 15 and look for it.

So that the 6 or 7% guaranteed return is figured in as part of the cost just as much as the wages or equipment or coal or any other item. Then, again, there are times when a premium is given for efficient management and economical control of the company. In the case of Dallas, Texas, where this plan is in operation, the plan provides for an increase of one-half of 1% on the return on the investment, where the rates are brought below those that are originally established. If, at the end of the year, it is found necessary to increase the rate to the consumer, there is a penalty of one-half of 1% deducted from the returns, in order to equalize the cost to the consumer again. That is done as a sort of incentive to economical and efficient management; that may or may not be incorporated. One of the outstanding features with reference to cost is the entire flexibility of the plan. Although the plan is in operation in 16 or 17 cities, there are no two cases where it is exactly alike, although fundamentally the same principles are involved in each case. The establishment of a reserve fund at the very beginning of operation of Service at Cost plan is one of its very desirable features. That is a sort of business barometer, based on a certain percentage of preceding year's gross earnings, and that reserve fund enables at all times people who have the interest of the company at heart or general public to determine what the financial conditions of the business is. From time to time, if that reserve fund has depreciated to the extent of 30% or 40% in the various cities, the price to the consumer goes up until that reserve fund is re-established. If the reserve fund is sufficient to increase that 40% or 50%, the rate to the consumer is cut down until diminished to its normal amount.

There is also an emergency fund. In the case of Dallas it is called an accident fund, and that also is separate and distinct from the other operating expenses. The whole plan is usually under supervision of what you call a Supervisor of Public Utilities. That is either a single headed commission or in some cities a commission of three or five men appointed or elected by the cities, whose powers are as broad as you care to make them. Some times they are in complete control; other times merely in an advisory capacity of public representative on the board of directors.

I will not suggest to you this morning exactly how this plan could be applied to power companies, but it is a matter that I would like to lay before Class "A" members, either now or at some other time, as to how Service at Cost could be applied to the power companies of Canada, particularly in Ontario, where the time is very close when an offensive and defensive alliance must be formed to protect the interests of the independent companies. The trend of conditions indicate that the pretentious programme of the Hydro people is such that we may look for some very interesting developments in the not far distant future, and Service at Cost, I believe, will represent, and represents

now, what is destined to be the salvation of many companies in the near future.

Quoting briefly from Dallas, their plan there provides and will pay the return to be authorized upon the property value; the property value of the company determined by board of arbitration—to create and maintain, after providing the return referred to, surplus reserve equal to at least 10%. They also provided there for 6% return on their property value as specified or determined by this board of arbitration. "Whenever the accident reserve . . . of six months. . . ." That is done to bring down the reserve fund and restore it to its normal amount. That is when the surplus increased sufficiently. Now, there are some technical features here that I have marked, if any gentleman, after the meeting, would care to run through this and see exactly how this plan could be practically applied to a city of their size, and the same would apply to other cities. I will not take up your time to go into this at length. It is tremendously interesting, and shows how this thing can be worked out practically. Many plans for the betterment of public utilities have been very good in matter of theory, but it is well to cite some plan that has been really worked out in practice. I know in the case of street railway companies where they were very sadly upset by conditions such as existed on every continent, that they have come to the conclusion that neither a fixed rate nor a zone system exactly met conditions. For this reason, while operating costs are constantly fluctuating, with upward tendency, the indications are that in the future there will be some reduction in operating cost, particularly in the matter of equipment, and any fixed rate established at the present time, while perhaps of sufficient volume to offset the present cost, might be too much to take care of the future cost, 5 or 10 years perhaps, so that they wanted a flexible, automatic adjustment charged to the consumer, and there was no other plan that provided that except Service at Cost, which rises and falls in its cost to the consumer based on the then existing cost of operation. Of course the interesting feature of Service at Cost to the investor is the fact that investment is always protected. There has been a growing tendency in recent years to rather ignore the shareholders and that they ought to be taken care of last; in fact, this has been openly advocated. Only recently in Toronto, where the trouble with the street railway is very much in the foreground, it has been openly advocated that if the shareholders were to lose by this present condition—why, let them take their loss. Service at Cost always provides for invested capital as part of the cost.

There are a number of other features of the Service at Cost plan which you will find in the booklets that I have brought here, and I have sufficient of them for distribution to all of you, which handles the subject at a little greater length, and perhaps if you take this book and at your leisure look through it, you will get the ABC of the plan, and you can see its adaptation to public utilities particularly

and its application to light and power, particularly its flexibility, its adjustable qualities to any local conditions, is something that has endeared it to cities of every country.

When this plan was started originally in Cleveland, Ohio, it was intended solely as a temporary solution, but since that time it has broadened out considerably.

Last year we took the thing over to Massachusetts and used it to solve a condition there that had defeated best efforts of legislature for a number of years, and that was in the case of Boston Elevated Railroad and Bay State System, the largest transportation system in the world. It has been used to solve the problem in Montreal. It is going to be applied in St. John, N.B., and probably other cities in the Dominion in the very near future.

If you will just run through this booklet, particularly in regard to the summary at the rear, in which it shows that the Service at Cost calls, first, for close public supervision, and I bear with special emphasis upon that, because I think you will all find at the present day if the public feels they are having a voice in the management of their public utilities it instils a degree of confidence which has been gradually lost in recent years, and if they can feel they are having a voice in the management of those companies, whether they have or not, why they are apt to have a restored confidence in the future in the conduct of the business. It also calls for an improvement in service and the maintenance of service at its best standard. It also demands efficient and honest administration. That is no reflection upon the present administration in any case, but it is well to hold that out to the public as one of the guarantees that plan carries with it. It provides essentially for just sufficient revenue to pay the actual cost of operation, and it is from that clause that the plan gets its name, Service at Cost. It guarantees the integrity of the investment at all times, as I have pointed out, by guaranteeing return on the capital, and restores credit of the utilities affected, and renews public confidence in them. Of course we all realize in the last 5 or 10 years the credit of the companies has been practically lost, and that is surely so in the case of transportation lines. But where a plan carries with it a guaranteed return on capital, it will invite capital investment at any time that the companies desire it for extension and improvements.

I think that that summarizes the plan about as clearly and briefly as it is possible to do it without going too far into the technical consideration of the thing, which I do not want to bore you with this morning. If you will run through this booklet you can get an idea of its application to other cities, the essential principles of the plan, how it can be applied, and it is worthy of note that it can be applied either to street railways, telephone, gas, electric light, heat, power, anything at all. It can be used just as effectually as it has been used in the case of the street railway companies. Its restoration of public

confidence is perhaps one of the best features of the plan, because in Cleveland and in Boston—particularly in the latter city, where people for years have fought against increase in fares from 5c to 6c—under public trial of Service at Cost they are going to pay 10c on the 1st of July, almost willingly, because the road is now under their own jurisdiction, and of course they feel anything they are doing themselves must be right—so they are paying 10c now, where they would not pay 6c before, and the same thing has been demonstrated in other cities.

In the case of Washington, D.C., the Public Service Commissioners gave the railways the right to charge 6c fare, after three or four years of fighting, and here only two or three days ago they supplemented that by giving the company the right to charge 2c for transfer. Why, in the old days that would have been almost a subject for revolution! In the case of Bay State road in Massachusetts, they had been struggling for years under 5c fare. As soon as the Service at Cost plan went into effect they charged 7c fare, and now they are going to increase the rate in about a month to 8c, with prospect before the first of the year it will probably be 10c, ten tickets for a dollar, no reduction, and the public seems perfectly satisfied.

It is only because this feature of public control has been inserted as part of the plan, and the people have been invited to come in and run this road with us, appoint your own commissioners on the board, your own board of directors, have a voice in the management of its affairs, and when the public steps in and has a chance of reviewing the operating conditions, and add up the receipts and expenses, and see where the company gets off, why they know there is only one alternative, only one logical thing to do, that is to charge enough to make the company self-supporting—and that has never failed to be true. As soon as the public have come to realize that what the company has been contending for years is true, they have invariably swung around and have advanced a higher charge than the company had ever dared to suggest in the past.

I will just leave that subject with you there. There are many other phases of it I would like to go into, but it is now getting pretty late, and there are some questions you would probably like to ask about this.

There are one or two gentlemen of authority that I would like to quote on the subject, whose opinions are worth while listening to, particularly from the financial end, but if there is anything that occurs to you as I go along that you would like to know more about, why do not hesitate to interrupt me.

James Speyer of New York, the financial authority, speaking about invested capital not long ago, said: "As the term 'labor' is commonly used to represent millions of working men so it should be borne in mind that the word 'capital' does not really represent a thing nor a few very wealthy men, but it means, in civilized countries, the savings of men and women of comparatively moderate means

which they have invested, either directly or indirectly, in industrial undertakings giving employment to millions.

Those investors, be they savings bank depositors, life insurance policy holders, owners of railroad and public utilities securities, etc., be they large or small, have, during the last few years, not been shown as much consideration as is necessary for the country's prosperity and development. I think the people of our country have come to realize that it is impossible for 'labor' to prosper if 'capital' is deprived of its fair return." And in that he merely voiced the opinion of competent authorities all over the world at the present time.

A very worthy thought in connection with Service at Cost is the fact that it has invariably received the unanimous endorsement of labor, and is quite essential in the present development in our industrial enterprises to reconcile labor with any enterprises undertaken. I have heard labor leaders argue for Service at Cost, when it appeared that certain defeat was facing this measure. When it came up before the Massachusetts Legislature last year, the representative of 25,000 street railway operators in the State appeared before the Legislative Committee, he stated, in a most profound and eloquent manner, that these 25,000 and more street railway employees were strongly back of Service at Cost, because it was the only plan of operation that had yet been proposed that gave a square deal to everybody concerned. And you can see why that must be so, because in summing up the items of cost you must take into consideration wages. Therefore labor is at all times provided for to any reasonable extent. Under our present operating conditions if labor makes apparently unreasonable demands for increased wages, there is nothing to provide for that in our operating costs at the present time. It is an added expense that must be met only by some added revenue. But by the automatic adjustment of Service at Cost wages always figure in as part of the cost, so that it is not necessary to go to the public continually and say, we will have to get a little more for service, after such and such a date our labor is going to cost more. So you see it is quite essential that labor should be reconciled to this plan of operation and give it endorsement, because it is a good factor to have —that is, in the carrying out of the successful operation of the plan.

I could read you an almost endless number of endorsements from competent authorities on Service at Cost; men who have gone into the subject and given years of thought and attention to it.

It is only a few weeks ago that at the Convention of United States Chambers of Commerce, Service at Cost plan was very highly endorsed when the convention took up the matter of public utilities. The American Railway Association at its convention in New York some few weeks ago also endorsed Service at Cost plan of operation. Ex-President Taft only last week, in appearing before the recently appointed Federal Street Railway Commission, highly endorsed the Service at Cost plan, and probably some of you gentlemen read his

remarks on that subject. He touched upon the present operating costs, and showed how they could not be met by any reasonable charge. He quite agreed that the old-time charges were inadequate. It is not so long ago that the United States Supreme Court, in the case of Detroit Street Railways, threw out the case of the city against the road, on the ground that the rates of fare established by the city for the road were inadequate to pay a reasonable return on the invested capital, that the company should be allowed to charge a rate of fare that would pay for the cost of service.

So that you see in all directions the trend of the times is for the company to be put on a self-sustaining basis; to make charges that will look after operating costs. In other words, get down to the Service at Cost basis.

If there is anything that you would like to ask about this subject, I would be glad to give you such information as I can on it. It is a subject I have been very closely identified with for a number of years, and have helped to put it into effect in a number of cities, and am even now at work on a draft of Service at Cost franchise for three other cities.

When the opportunity arrives I should like to lay before your Executive Board its adaptability to heat, light and power companies, particularly in Canada, at the present time. I thank you, gentlemen.

The President: I am sure we are very much indebted to Mr. Fredericks for his paper. If there is any question that any member of the convention would like to ask him, I am sure Mr. Fredericks would be only too glad to answer the question put. The matter is open for discussion or questions.

Mr. Dion: Mr. President, I personally feel very thankful towards Mr. Fredericks for having brought this important subject to our attention. I have read something about it, and I am very much taken up with the plan. I believe, as Mr. Fredericks, that it may prove to be the salvation of several companies in this country. Whether it will be so or not will depend largely on the companies themselves, in the manner in which they may be able to, or the extent to which they may be able, to educate public opinion in the various localities. Companies in this country have seen their credit impaired by existing conditions, and when they find themselves unable to finance their undertakings any longer, it seems, in the Province of Ontario where I belong, there is only one thing to do in such a contingency—to invite the public to take over the enterprise at whatever price they may see fit to do it, since there is no alternative. This Service at Cost plan has the merit of furnishing an alternative, a plan whereby the community may get practically the same benefits as with public ownership in some directions, and greater benefits in other directions, while at the same time safeguarding the interests of the shareholders. I had an illustration of the value of this plan in its fundamental principles lately in a

small public utility undertaking in which I was interested, which found itself, due to war conditions and other conditions, practically unable to continue operations for very long. It put up the situation to the city authorities, pointing out to them its inability to continue operations, and suggesting that the city should either take over the undertaking or put the company in a condition to continue operations. The City Council met the company in a very fair spirit, stating that they quite understood the situation. They did not want to take over the enterprise. They were willing, however, to make a new agreement with the company which would enable it to go on with the operations, but they were in a difficulty as to what to do or as to the extent of the relief they should offer the company. The fare and other conditions cannot justly be fixed for the whole period of the franchise, as stated by Mr. Fredericks. The city might give relief which would be adequate to-day and inadequate in the future, or they might give relief which would be adequate to-day and which would be more than the company really needed in the future. The result of this condition of mind was that we could not get together on any terms until later, when having got a copy of the Montreal agreement, which is a Service at Cost agreement, I was able to study it a little, and I found in it means of assuring the city that they might give relief without any fear of giving too much, because they would automatically, under some such plan, get refunded to them at the end of each year any excess in the relief which had been given to the company. This was at once a means of getting together, and while the plan the company suggested is not exactly that of Service at Cost in all its features, it is fundamentally such, and it has resulted in a new franchise agreement being drawn, which will supersede the old franchise agreement, and will probably fully safeguard the capital of the company and ensure the continuance of the service. This agreement is practically completed; it only remains to be voted, of course, by the ratepayers, as all such agreements must be so voted.

This is a concrete case where the principle of the Service at Cost plan will most likely be the means of saving the company from ruin and insuring to the citizens the continuance of the operation of the utility. Feeling as I do about this Service at Cost plan, I would like to see this Association endorse it, if it is possible or if politic to do it, in order to give it a greater recommendation.

The President: Any other gentleman who would like to speak on the subject? Mr. Davies, have you any thought on this subject? Mr. Gould, have you anything you would like to say to us on this subject?

Mr. Gould: I have not given this subject much consideration. Certain it is that no company can do business at cost; it has got to have cost and something more or it cannot live. It seems to me this is a fair way to arrive at conclusions and so average things up that every person connected with the institution, the community as well as the investors, can all live. After all, it only amounts to what is fair.

PROCEEDINGS OF

ANNUAL CONVENTION

30th Year

Canadian Electrical Association

HELD AT MONTREAL, QUE.

JUNE 16 and 17, 1920

Office of the Association
601 POWER BUILDING
MONTREAL, QUE.

WE respectfully suggest that our members take SPECIAL NOTICE of the Advertisements distributed amongst the papers and discussions and bear them in mind when in need of materials.

CANADIAN ELECTRICAL ASSOCIATION

OFFICERS, 1920-1921

President:
A. Monro Grier, K.C.,
Canadian Niagara Power Co., Niagara Falls, Ont.

1st Vice-President:
P. T. Davies,
Southern Canada Power Co., Montreal, Que.

2nd Vice-President:
A. P. Doddridge
Quebec Rly., Light, Heat & Power Co., Quebec City, Que.

3rd Vice-President:
L. W. Pratt
Hamilton Cataract Light & Traction Co., Hamilton, Ont.

Secretary-Treasurer:
Eugene Vinet
The Shawinigan Water & Power Co., Power Bldg., Montreal, Que.

ADVISORY COMMITTEE

Composed of Past Presidents Eligible for Office.

EXECUTIVE COMMITTEE

Chas. T. Barnes,
The Toronto & Niagara Power Co.

R. J. Beaumont,
The Shawinigan Water & Power Co.

N. S. Braden,
Canadian Westinghouse Co., Hamilton, Ont.

A. A. Dion,
The Ottawa Electric Co.

A. V. Gale,
Hull Electric Company

F. T. Kaelin,
The Shawinigan Water & Power Co.

S. L. B. Lines,
The Lincoln Meter Co., Limited, Toronto, Ont.

D. H. McDougall,
The Toronto Power Co.

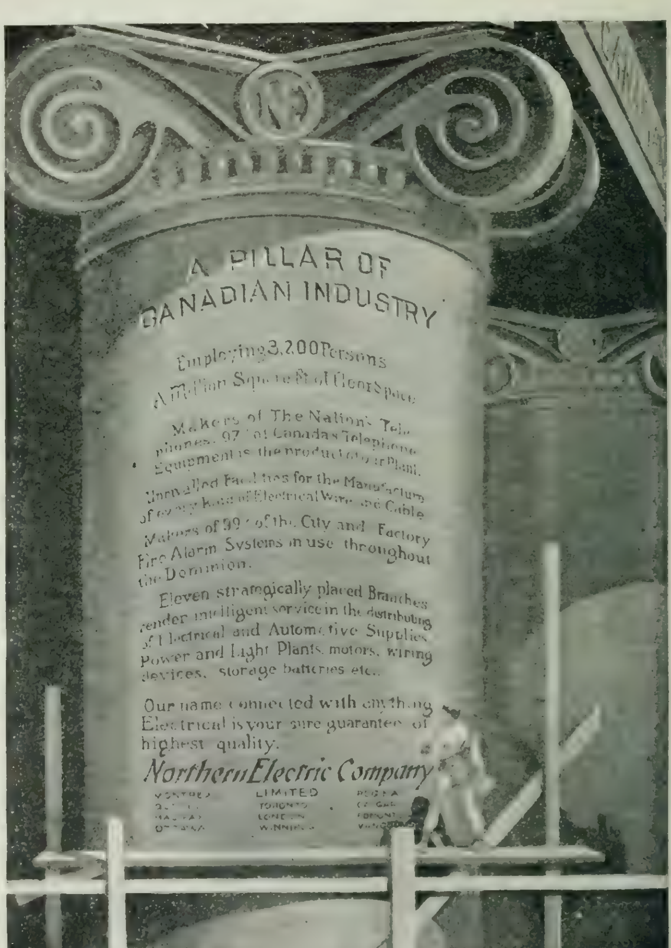
J. S. Norris,
Montreal Light, Heat & Power Consolidated.

M. K. Pike
Northern Electric Co., Montreal, Que.

J. W. Pilcher,
Canadian General Electric Co., Montreal, Que.

J. B. Woodyatt,
The Southern Canada Power Co.

The President,
National Electric Light Association, N.Y.


A PILLAR OF
CANADIAN INDUSTRY
Employing 3,200 Persons
Makers of The Nation's Telephones.
Equipment is the product of our Plant.
Makers of 99% of the City and Factory
Fire Alarm Systems in use throughout the Dominion.
Eleven strategically placed Branches render intelligent service in the distributing of Electrical and Automotive Supplies, Power and Light Plants, motors, wiring devices, storage batteries etc.
Our name connected with anything Electrical is your sure guarantee of highest quality.
Northern Electric Company
LIMITED
TORONTO
WINNIPEG

CONTENTS

INDEX TO ADVERTISEMENTS

PROCEEDINGS

The Thirtieth Annual Convention of the Canadian Electrical Association was held in Montreal at the Ritz Carlton Hotel on the 16th, 17th and 18th of June, 1920.

Although the attendance was not the largest in the history of the Association it was a very earnest and enthusiastic aggregation of the Central Station industries and allied interests.

It was also a fact for congratulation to have as guest, Mr. Martin J. Insull, President of the National Electric Light Association.

President A. Monro Grier in the Chair.

The President:—I call the meeting to order. I see the first item on the programme is the opening remarks of the President. With your kind permission I think, if you do not mind, I will treat those opening remarks in this manner:

It is an exceedingly pleasant day and we all have the great fortune to be assembled in the city of Montreal. Those two circumstances are quite enough to make us feel very joyous indeed in beginning this Convention. My anticipation is that, despite the shortcomings of the President, and thanks to the merits of the other members of the Association, we are going to have an uncommonly satisfactory Convention I hope sincerely that it may be so, particularly because, as I dare say all of you now know, there is in contemplation a change in the headquarters of the Association, and it may be that it will be our good fortune to have them fixed, for at all events some stated period, in the city of Montreal. That, of course, is something that will be dealt with by the executive session on the concluding day of the Convention.

We are all exceedingly glad to have visitors from the United States with us this morning, and shall, throughout the Convention, be glad to have them. Later on I hope it will be our good fortune to hear from all of those visiting us, but I am glad to assure them now that we are all thankful to think that they are either with us now or will be with us during the course of the Convention.

The Secretary, in this connection, has directed my attention to this important announcement that Mr. Martin J. Insull will arrive this evening and I trust, even though we may not have the pleasure of hearing him this evening, we shall certainly have the pleasure of listening to him tomorrow.

For the purpose of one particular item I shall now declare that we are in Executive session. I say this so that we may as nearly as possible conform to one of the rules of the Association which, generally speaking, we have ignored to a certain extent. This should strictly have been done some time ago, but it has been our wont to do it at the Convention itself; that is to say, to appoint a Nominating Committee. My difficulty of course, has been that there are so many excellent men, each and all of whom might be nominated and I have thought to deal with it along geographical lines so as to dis-

tribute the personnel, as far as possible, throughout portions of Canada represented here, and I have, therefore the pleasure of naming on the Nominating Committee Mr. D. H. McDougall, of Toronto; Mr. Dion, of Ottawa; Mr. Pratt, of Hamilton; Mr. Gould, of Rideau Power Company, and last—reserving it to the last, not as a matter of disrespect but of honour—Mr. Bagg, of Montreal.

The next item is the Minutes of the 1919 Annual Convention.

MR. WM. VOLKMANN, *Secretary*:— The Minutes of the 1919 Annual Convention are all as published in the report of the 29th Annual Convention. I do not think that it will be necessary for me to read last year's Proceedings as published, probably a motion to adopt as printed will be in order.

MR. J. B. WOODYATT:—I would like to move that they be adopted as printed.

Mr. D. H. McDOUGALL:—I second that motion. (*Carried.*)

THE PRESIDENT:--The next item of business is the Report of the Secretary-Treasurer, Mr. Volkmann.

REPORT OF SECRETARY-TREASURER, 1919-1920

Mr. President and Fellow-members:—The past year has been a very busy and trying one for the Association, especially in respect to our affiliation with the N. E. L. A., due to the casting of its Constitution and activities.

The N. E. L. A. last fall put up to this Association the collection of the percentage dues of our member companies in cities of over 25,000 population. There were at that time 16 such members of which 14 were in arrears, some as far back as 1914. After considerable correspondence on the part of the Secretary, the N. E. L. A. agreed to cancel all back outstanding dues if members in arrears paid their 1919 and 1920 percentage dues. I take pleasure in reporting that all but five of our member companies are now in good standing. This item has involved considerable time and correspondence on the part of the Secretary.

The Executive of the Association have held three meetings during the past year, two at Montreal and one at Toronto, as against one in 1918 and 1919.

As a result of the discussion arising at these mee ings, involving the question of percen age dues, the present status of our Association in the N. E. L. A. and the change in the organization of the N. E. L. A., it was shown that our present constitution which was adopted in 1911 needed revision. Your Secretary with the approval of the President, undertook, after a conference at New York, with Mr. Aylesworth, Executive Manager, N. E. L. A., the entire revision of our Constitution. This was submitted at our last Executive meeting at which it was gone over in detail. This proposed revision of the Constitution will be submitted for the approval of the Association at the Annual Executive Session on Friday.

The N. E. L. A. at its Annual Convention at Passadena May 18-22 adopted a revision of its constitution involving a complete reorganization of the Association and its activities. It is its desire that the Canadian Electrical

Association work in complete harmony with it as reorganized. I, however, will not touch on this as we will have President Insull with us to tell us all these details.

FINANCES.

The Association is in an extremely good condition with respect to finances. As contracted with a deficit in 1917, which required special subscriptions from our company members, we now have asse s to the extent of over $3,864.00, including $700.00 in fully registered Victory Bonds issu d in 1918. The funds of the Association were increased by $605.00 in 1918; by $1,092.00 in 1919; by $1,445.00 in 1920, over and above all expenses. In addition to this there is appoximately $950.00 outstanding being fixed and percentage dues for the calendar year, of which one-half is owing to the N. E. L. A. when collected. The unpaid accounts outstanding do not amount to over $60.00.

The disbursements for the past year have been somewhat above those of the previous year principally due to the higher cost of printing and stationery.

PROCEEDINGS.

The 1919 proceedings consisted of 136 pages of printed matter against 84 pages for 1918, this increase being due largely to a greater discussion of our papers at the last Convention. hope that the discussion of this year's papers and reports will also exceed that of last year, as after all it is the discussion that carries the greatest interchange of ideas. These proceedings are printed so that there may be a permanent and authentic record of our Annual meetings.

It may be of some interest to our members to know how this item is handled. We receive from our stenographer two copies of the discussion. One copy of the stenographic notes is cut up and the remarks of each delegate assembled and forwarded to him for correction. After return of corrected notes, the changes are all noted in the permanent record which, with reports, is turned over to the printers. The first or galley proofs returned are all carefully read for errors and corrections and edited, after which they are returned and corrections made. Page proofs are next submitted which again are carefully and completely checked for correction of errors, location of cuts, etc., and if correct are returned for final printing and binding.

During the past year, in addition to our own standing committees, and our representatives on N. E. L. A. committees, we have had representatives on two sub-committees of the Canadian Engineering Standards Association one dealing with standardization of lamps and one dealing with standardization of distribution transformers.

In closing this annual report I desire to thank all members of the Association and the Executive for their hearty co-operation during the past year.

Respectfully submitted,

WM. VOLKMANN, *Secretary-Treasurer.*

REPORT OF AUDITOR.

RECEIPTS.

Cash on Hand and in Bank, June 1, 1918		$1,732.15	
Membership dues Class A	$ 695.00		
" " " B	505.00		
" " " C	95.00		
" " " D	370.00		
" " " E	160.00		
Membership dues percentage	2,457.28		
		4,282.28	
Electrical Employers' Association		500.00	
Sale of Handbooks		15.00	
Interest on Victory Bonds		38.50	
Sundries		25.30	
			$6,593.23

DISBURSEMENTS.

Stationery and Printing	$ 104.00	
General Office Expenses	104.60	
Travelling Expenses	123.00	
Electrical Employers' Association Expenses	200.24	
Postage	68.34	
Exchange on Cheques	7.27	
Auditing to June 16, 1919	40.00	
Printing Proceedings	589.00	
Convention Expenses, 1919	268.81	
National Electric Light Association Percentage	996.98	
National Electric Light Association Handbooks	6.00	
Honorarium, Secretary-Treasurer, 1919	500.00	
Cash in Bank	3,562.19	
Cash on Hand	22.80	
		$6,593.23

MR. A. MONRO GRIER, PRESIDENT,
Canadian Electrical Association.

DEAR SIR:—I hereby certify that I have examined the books and vouchers of the Canadian Electrical Association and have found them to be in accord with above statement.

Yours very truly,

Toronto, June 8, 1920. W. S. ANDREWS, *Auditor.*

THE PRESIDENT:—Anything arising out of the report of the Secretary-Treasurer? If there is not, I shall be interested in hearing a motion for its adoption. I should like to make this observation myself: Two things must impress us in listening to the Report, the zeal and activity of the Secretary and secondly the good result of that zeal and that activity.

MR. R. B. McDUNNOUGH:—I would beg to move the adoption of the Secretary's report.

MR. D. H. McDOUGALL:—In seconding that motion I want to emphasize the remarks you have made as to the pains and care and amount of labour that the Secretary has put on the work during the past year, because I happen to know—he being in my office—I happen to know a good deal about

it, and I think the Association is to be congratulated upon the Secretary that it has had, and upon the success of the year's work as exemplified by the report. I have much pleasure in seconding the motion. *(Carried.)*

THE PRESIDENT:—There is no special correspondence, which is the next item on the programme, and so we will pass on to the first Report, which is the Report of Committee on Meters by Mr. Turley, of the Montreal Light, Heat & Power, Consolidated, who is chairman of that committee.

May I say this, at this juncture, I have the pleasure of meeting here, and have had the pleasure of meeting elsewhere, many gentlemen connected with electrical interests in various parts of Canada. My memory of faces, I believe, is fairly good; my memory of names, taken alone, is not bad. My memory of faces taken in conjuntion with names is not very good, and I should consider it a very great kindness on the part of anyone, should I not have the good fortune to recall the connection between the name and face, to tell me what that connection is.

MR. E. J. TURLEY:—Mr. Chairman and gentlemen, with regard to the Report of the Meter Committee, I note in the programme as laid out, that you have Report of Committee on Meters and also later on you have Meter Committee of N. E. L. A. I would like to be permitted to alter that a little and read first the Report on Committee of N. E. L. A., and then Report of the Meter Committee, the reason being that there are a lot of matters taken up by the N. E. L. A., of which our Report is practically a continuation.

THE PRESIDENT:—That strikes me as an altogether good suggestion.

MR. TURLEY:—I would like to read that Report first, and then continue our own Report.

REPORT ON WORK DONE BY THE N.E.L.A. METER COMMITTEE, 1920

I attended some of the meetings of the N.E.L.A. Committee. Their report has been printed and will probably be available in a short while.

One of the questions with which they dealt at considerable length this year, was the question of training of Meter Testers. Of course, their system of testing meters is somewhat different from our system, and I personally believe it is more practical and also that it would be worth consideration, to arrange a combination of the good points of their system and the good points of our system, and if possible, have it adopted for use in Canada.

They sent questionaires to 150 Companies asking their experience with regard to the training of Meter Testers, and the reply was tabulated and the following conclusions were drawn:—

(1) A need is felt for an outlined course supervised by an instructor to be given partly on the Company's time and partly on the employees' time.

(2) The apprentices should preferably have a high school and at least a grammar school education, and should be trained for general meter testing rather than specialized work.

(3) The Meterman's Handbook should be loaned gratis to the apprentices.

(4) A spirit of competition or friendly rivalry should be encouraged among the students in the course.

(5) The apprentices should start their training in the meter shop and receive a series of written examinations to be followed later on by oral quizzes on their papers, outlines of the various courses are all shown in their report. Owing to the extent of territory covered a Western Sub-Committee was formed, the subjects dealt with then were as follows:—

(1) Entrance switches and testing devices.

(2) Special meter schemes.

(3) K.v.a. demand measurements.

(4) Fusing of potential transformers.

(5) Current and potential limits of self-contained watt hour meters.

(6) Out-door metering equipment, and the following were the conclusions arrived at:—

With regard to No. 1, such divergent ideas existed that it was concluded to refer the whole matter to Sub-Committee for next year.

With regard to No. 2, a large number of special metering connections according to special requirements were found.

(1) One company, using to quite an extent, a single polyphase meter for three-phase power and three-wire lighting, and a somewhat similar scheme for metering two-wire and three-wire lighting, also several three-phase measuring schemes different from the standard were found in service in a number of cases. Diagram and proof of all these are being prepared for possible inclusion at some future time in the Meterman's Handbook, when it may be revised, thus making it available for all member companies.

Regarding the No. 3 K.v.a. hour and demand meter measurements. There was a divergence of opinion as to how the low-power factor condition

should be dealt with. The most generally used meter in service was found to be a combination of two watthour meters, one measuring the watt component, the other the reactive component.

From the record of the two the kilowatt hours were derived or the power factor depending upon the system of charging. The Committee decided that in as much as the fundamental question of the definition of power factor was still open no conclusive recommendation on k.v.a. and demand meters should be made at this time.

Regarding No. 4 Fusing of potential transformers. It was found that most companies did not fuse potential transformers used with watthour meters on 6600 volts or less,as they prefer meeting the hazard of not protesting potential transformers to the difficulty of adjusting bills rendered incorrectly due to non-registration of one meter for an unknown period of time.

(5) Current and potential limits of self-contained meter. The Committee felt that it is not advisable to set a standard at the present time as to the upper limits of either current or potential of self-contained watthour meters.

(6) Out-door metering. It was found that there was room for considerable improvement by the manufacturers to meet the requirements of this service, and that the system which seems to have proven the most satisfactory consisted of an out-door pole-type current and potential transformer the meter installed at the bottom of the pole.

The Sub-Committee on instrument transformers did considerable investigation with reference to test methods standardization of type and accuracy. They decided that an effort should be made to bring about standardization in terminal dimensions and provision for mounting current transformers, and that this standardization should be as regards transformers of the same type and different ratings as regards transformers of different types, as if possible as regards transformers of different manufacture, this applying more particularly to the variations of distances between centres of bolt holes for mounting, as the companies are put to considerable expense in making replacemen's in case of burn-outs.

With regard to breakdown test. The practice adopted on potential transformers was to use a test voltage twice the rated voltage, plus 1000 volts, and with regard to current transformer, twice 1/4 rated voltage plus 2000 volts.

With regard to initial accuracy test. These were made under two heads, light load representing 10% or less of the transformer rating, and full load representing 75% or more of the transformer rating.

An average of all tests showed a light load accuracy of 99.99%, and a full load accuracy of 99.46%.

The average accuracy of the potential transformers was not quite as good, maximum inaccuracy reported was slightly over 2%.

It was the opinion of the Committee that a test on both current and potential transformers should be made for initial accuracy at as nearly as possible to the loads that would be met in service, and that corrections for errors and inaccuracies should be made in all cases where the importance justified.

There was also made a sustained accuracy test after a period of from two to seven years in service.

The average change in accuracy was shown to be .115% at light load, and .118% at full load. This is so small a change as to be negligible and leads to the belief that there was really no permanent change in the transformers between tests.

The conclusion arrived at was that the probability of change due to service usage on current transformers of modern type was small, excepting cases where there are external evidences of damage, or where conditions of usage such as opening of the secondary circuit under load would lead to the belief that the characteristics of the transformer had been changed.

As to the question of standardization of disc constant and watthour meters, it was the unanimous opinion of the Committee at one of its meetings that the desirability of having a uniform disc constant for the same ampere rating and voltage range and increasing in direct proportions to the capacity of various makes of meters, should be brought to the attention of the manufacturers for action at as early a date as possible.

This question was brought to the attention of the manufacturers and while they all agreed to the convenience and saving that would undoubtedly result, they felt that it was not practicable at the present time to make the change. The Sub-Committee were instructed to continue their efforts with a view to arriving at some standard which would be universally satisfactory and lend itself without too much cost to the new construction.

The Committee also did considerable investigation with a device for demand meters known as the "Knopt" device, but are not prepared after investigation to recommend its universal adoption, although believing that it had advantages for certain requirements.

They also made investigations on a device known as the "Curve Straightening Device," the object of the device was to straighten the curve of induction watthour meters on heavy overloads.

The device is in the form of a small transformer having two windings, connected in series, and the other in parallel with the current coil with the watthour meter.

The device is small enough to install within the meter case. The conclusion arrived at was that a watt hour meter equipped with this device may be of value to some companies having installation with heavy overload characteristics, where the power factor and light load conditions are such as not to affect its accuracy, and where the installation of the larger meter would not meet all the conditions of loads.

The Committee also reported the following new developments:—

Type M7, Demand Meter Register. General Electric Company.
Volt Amp. Hour Meter " " "
Type C.A. Graphic Instrument. " " "
Graphic Watt Hour Meter. " " "
Type R.H. Demand Meter Westinghouse, (Lincoln).
Electrostatic Glow Meter Westinghouse.

After listening to the various reports and examining them carefully, I have come to the conclusion that the question which most affects metering of

electric current in the U.S.A. at the present time is one of standardization of meters and allied equipment, and we in Canada at the present time should, I believe, take steps if pos ible to overcome this difficulty before our equipment reaches a point where extensive alterations due to standardization would be prohibitive in cost.

My suggestion would be that the Canadian Standard Association be requested by the Canadian Electrical Association to arrange for a Committee on the Standardization of Electric Watthour Meters, also Potential and Current coils.

REPORT OF METER COMMITTEE FOR 1920

The Committee this year made investigations with reference to the accuracy of meters after being in service for seal period and longer.

This investigation was made with the view to trying to find if it were not advisable to petition the Government to change the seal period on Electric Meters.

A number of member Companies were asked to report on the accuracy percentage of meters they find, of inaccuracies at the time they were brought in for re-seal, and the unanimous opinion was that meters of the new design, i.e., of the designs since 1910, were found to be very little changed after operating continuously from five to nine years.

There was, however, a small percentage of the meters made previous to this date which varied slightly after being in service for longer than six years.

In one instance where a careful record was taken of 5,000 meters which had been in service from six to nine years, only 1% were found to be outside of the Government requirements, and this 1% is a question if the error was not caused by transportation, and this brought up a question as to whether it would be more economical, too, instead of following the practice which exists at present in nearly all Canadian Companies, viz., that of removing of meters to the shops for cleaning, and repairing at the end of their sealed period.

The idea which we had in view was, that if the meters after being in service for the duration of their sealed period were tested *in situ* and found to be correct, they should be sealed and left for another five years, and if found to be incorrect, they would be removed to the shops and repaired, cleaned and re-sealed for future service.

Several of the Companies furnished reports of the cost covering removal, repairs and re-sealing, including the cost of seal, and the average of these was $1.70 per meter.

We also had prepared an estimate by two of the member Companies, giving the probable cost, and the estimate showed that with the extra charge of $1.00 made by the Government for meters tested *in situ*, that it was cheaper to follow the present practice. However, we believe if the Government were properly approached they would reconsider this excessive charge and alter it to such a rate that meters could be economically tested *in situ*.

We believe if this practice were adopted it would do away with the breaking of a large number of jewels, which under the present system are injured in transportation.

With regard to the extension of Seals. The majority were of the opinion that the seal date could be extended to eight years without seriously impairing the high standard of accuracy which at present exists in Canadian meters.

Data collected showed that at least 98% of the meters were within Government limits when removed for re-seal.

Your Committee also considered the question of a uniform Disk Constant for all integrating watt hour meters, and concluded that the adoption of the uniform Constant for all is an important consideration, and the consent of the manufacturers to the manufacture of the meters with this Constant, in future should be seriously considered.

The Constant suggested is based on .25 watt hours for every 550 watts of meter capacity, the Constant to be in terms of watt hours, i.e., a five ampere operating on 110 volt circuit would be so constructed that for every revolution of the disk the meter would register .25 watt hours, which means that the speed of the meter would be 33 1-3 revolutions per minute.

Your Committee have this year been furnished with detailed information with reference to Lincoln Demand Meters, also the Type M. 7 of the General Electric Co.

We have not made any extensive investigations with regard to either of these, but from information obtainable, it would seem that they are well worth serious consideration for services for which they are intended.

The Lincoln Demand Meter was designed with the idea in view that the customer should be charged, as nearly as possible, on the effect of his class of demand on the supply companies' transformers and equipment. It is a Kilowatt Demand Meter which measures the heating effect on the equipment.

A small number of them are at present being tried out by some of the member Companies, but no definite reports have been furnished us yet.

Another matter which is of considerable importance, especially to member Companies in Quebec, is that of having adopted a law similar to the one under which the Ontario Companies operate in connection with the sealing of fuses on the inlet to the meters.

We believe that a Committee should be formed amongst the Quebec Member Companies, with the object of preparing and endeavouring to have adopted, a law covering this matter.

RECORD SHOWING ERRORS FOUND IN DIFFERENT MAKES OF METERS WHICH HAD BEEN IN SERVICE FOR PERIODS FROM 1 TO 9 YEARS—THESE METERS PRACTICALLY ALL TESTED NIL WHEN SEALED.

Make	Type	Cap.	Date of Seal	Date Returned	% of Error Full Load	% of Error Light Load	Remarks
Westinghouse	C.B.	5	1912	October 25, 1919	+2.3	+2.0	
"	"	5	1912	"	+3.3	+2.0	
"	"	5	1913	"	+1.4	−1.0	
"	"	5	1913	"	+1.7	+1.0	
"	"	5	1913	"	+1.3	Nil	
"	"	5	1913	"	+3.0	+4.0	
"	"	10	1913	"	+1.8	−2.0	
"	"	5	1915	"	+4.7	+4.0	
"	"	5/50	1915	"	+0.7	+2.0	
"	"	5	1918	"	+2.4	+1.0	
"	"	5	1918	"	..	..	Burnt Out.
"	"	5	..	"	+3.8	+3.0	Blurred.
Ferranti	C.	5	1910	October 27, 1919	+0.3	Nil	
"	"	5	1912	"	+5.5	+6.0	
"	"	5	1912	"	+2.7	+1.0	
"	"	5	1912	"	Nil	Nil	
"	"	5	1912	"	+1.0	Nil	
"	"	5	1912	"	Nil	Nil	
"	"	5	1912	"	+4.0	+3.5	
"	"	5	1912	"	+1.3	Nil	
"	"	5	1912	"	+4.0	+3.0	
"	"	5	1912	"	+1.2	Nil	
"	"	5	1912	"	+1.4	+1.0	
"	"	5	1917	"	−6.0	−8.5	
"	"	5	1919	"	+0.7	+1.0	
"	"	5	..	"	+1.2	+1.0	Seal Melted.
C.G.E.	9	5	1911	October 25, 1919	+2.0	Nil	
"	9	5	1911	"	Nil	−1.0	
"	9	5	1912	"	+3.3	+2.0	
"	9	10/100	1912	"	+1.4	Nil	
"	9	5	1912	"	+0.8	+1.0	
"	9	5	1912	March 18, 1920	Nil	Nil	
"	9	5	1912	"	+1.2	Nil	
"	9	5	1912	"	+0.6	Nil	
"	9	5	1912	"	+1.2	Nil	
"	9	5	1912	"	+1.0	Nil	
"	9	5	1912	"	+1.7	+2.0	
"	9	5	1913	October 25, 1919	+1.3	+2.0	Very Noisy Hum-
"	9	5	1913	"	Nil	+2.0	[ming in Coil
"	9	5	1913	"	+1.0	Nil	
"	9	5	1913	"	+1.1	+1.0	
"	9	5	1913	"	+0.7	+1.0	
"	9	5	1913	"	+0.7	−1.0	
"	9	5	1913	"	+1.2	+1.0	
"	9	5	1913	"	+1.0	+1.5	
"	9	5	1913	"	Nil	Nil	
"	9	5	1913	"	Nil	−1.0	
"	9	5	1913	"	−0.4	−1.5	
"	9	5	1913	"	−0.4	−5.0	
"	9	5	1913	March 18, 1920	+2.2	Nil	
"	9	5	1913	"	+0.6	−3.0	
"	9	5	1913	"	+0.4	−1.8	
"	9	5	1913	"	+1.4	+4.0	
"	9	5	1913	"	+2.0	Nil	
"	9	5	1913	"	−0.7	+1.0	
"	9	5	1913	"	+2.3	+2.0	
"	9	5	1913	"	Nil	+0.5	Very Noisy in Coil
"	9	5	1913	"	+1.2	Nil	
"	9	5	1913	"	+0.4	−1.5	
"	9	5	1913	"	+1.6	+2.0	
"	9	5	1913	"	+1.3	−1.0	
"	9	5	1913	"	+1.8	+1.0	
"	9	5	1913	"	−1.0	−2.0	
"	9	5	1913	"	+3.2	+2.5	
"	9	5	1913	"	+0.6	+1.0	
"	9	5	1913	"	+1.8	+2.0	
"	9	5	1913	"	+0.4	Nil	
"	9	5	1913	"	+0.7	+1.0	

RECORD SHOWING ERRORS FOUND IN DIFFERENT MAKES OF METERS WHICH HAD BEEN IN SERVICE FOR PERIODS FROM 1 TO 9 YEARS—THESE METERS PRACTICALLY ALL TESTED NIL WHEN SEALED.

Make	Type	Cap.	Date of Seal	Date Returned	% of Error Full Load	Light Load	Remarks
C.G.E.	9	5	1914	October 25, 1919	+6.2	+5.0	
"	9	5	1914	"	+1.0	Nil	
"	9	5	1914	"	+1.5	+2.0	
"	9	25	1914	"	Nil	−2.5	
"	9	5	1914	March 18, 1920	+1.3	−6.0	Creeping.
"	9	5	1914	"	+1.0	−0.5	
"	9	5	1915	"	+1.4	−1.5	
"	9	5	1915	October 25, 1919	+0.6	Nil	
"	9	5	1915	"	+0.4	+1.0	
"	9	5	1916	"	..	..	Cover Smashed.
"	14	50/5	1916	"	+8.0	+7.0	
"	9	5	1917	"	−1.3	−2.0	
"	14	5	1917	"	..	..	Standing.
"	14	5	1918	"	+0.6	Nil	
"	9	5	1918	"	..	..	Burnt Out.
"	9	5	1919	"	+2.7	+1.0	
"	9	5	1919	"	..	..	Standing—Some-
"	9	5	1919	"	+2.0	−2.5	[thing loose inside.
"	14	5	1919	"	−2.0	−7.0	
"	9	5	1919	"	+1.0	+1.0	
"	9	5	1920	March 18, 1920	+0.5	+1.0	Noisy in Coil.
"	9	5	..	October 25, 1919	+1.4	−1.0	
"	9	5	..	"	Nil	+2.0	Seal Blurred.
"	9	5	..	"	+1.2	+1.0	" "
"	9	5	..	"	+1.0	Nil	" "
"	9	50/5	..	"	+1.3	Nil	Seal Broken.
"	9	5	..	March 18, 1920	+1.6	+2.0	Seal Blurred.
"	9	5	..	"	−0.6	−17.0	" " [Creeping Backw'd.

TEST BY MEMBER COMPANY OF 100 METERS AFTER 5 YEARS IN SERVICE
1 Meter Found 4% Slow.
1 Meter Found 3% Slow.
1 Meter Found 3.4% Fast.
97 Meters Found O.K.

TEST BY MEMBER COMPANY OF 2,432 METERS AFTER 5 YEARS IN SERVICE
250 Meters Found Slow.
2,182 Meters Found Correct.

TEST BY MEMBER COMPANY OF METERS AFTER 5 YEARS OR MORE IN SERVICE
98% of Meters Found Correct.

Respectfully submitted:— A. A. Dion, L. W. Pratt, E. R. Spence, Wm. Volkmann, P. S. Gregory, A. H. Winter-Joyner, E. J. Turley—*Chairman.*

MR. TURLEY:—I have much pleasure in moving the adoption of this report. The above tables are in reference to the test whi h had been made on those meters that have been in service. Some of these show meters in service nine years which showed absolutely no variation from the initial installation test.

THE PRESIDENT:—It is moved that this exceedingly interesting report be adopted. Will someone kindly second it?

MR. J. S. GOULD:—I second the motion.

THE PRESIDENT:—I want to say just a word or two—not to hear myself speak, but because I want to hear others speak. In the first place I will make the request that anyone speaking, on getting up, give his name so that the reporter may get it.

In the second place, I am always delighted, if at the Convention, we get a sort of battledore and shuttlecock between the different minds here.

That is largely what these Conventions are for, and I am always distressed because I feel there are men of very considerable knowledge and worth, attainment and thought in various branches who, by reas n of their modesty, do not speak when they might, with great effectiveness and great use to us all. I should like any here who are conversant with any subject to know this, that they are very much better worth listening to than is the present president of this Association. I, at the utmost, am a mere sort of exciting generator. My object is to get the machinery which is really worth while, going.

Will you please bear in mind, if there is any point which you would like to have cleared up or if there is any point on which you feel you have something worth while to say, or if there is any point on which, in your mind, there is any obscurity, any contribution along this line, so far from being in the nature of an impertinence is really a great kindness, for essentially Conventions are for the purpose of minds meeting minds and in that attrition to get mutual benefit.

The meeting is now open for discussion upon this report.

May I bear my testimony to this effect, that it struck me as remarkable for the amount of meat there was in it and for the amount of clearness and interesting information generally.

MR. L. W. PRATT:—I would like to start the ball rolling by moving that a local committee be appointed, with Mr. Turley as chairman, with power to select his own fellow-members, to interview the Canadian Bureau of Standards with a view to obtaining the standardization of disc constants and instrument transformer sizes and specifications, which is something that I I think should be brought under the control of the Canadian Bureau of Standards.

This was suggested by Mr. Turley and I do not know of any better or more constructive work that the Meter Committee can take up than to bring this about.

MR. MCDUNNOUGH:—I will second Mr. Pratt's motion.

THE PRESIDENT:—It has been moved and seconded, as indicated in Mr. Pratt's remarks. Of course the motion itself is a contribution to the discussion because it is a suggestion that force should be given to suggestion made in the report itself. If there is no discussion under this motion I shall put it to the meeting. Perhaps some gentleman wishes to say something about it.

MR. E. CRAIG:—Do I understand that you want the Canadian Department of Trade and Commerce to specify a standard disc constant for watt hour meters? I think it is all right for the Meter Committee to ask the makers to adopt a standard disc constant for the new meters as this will affect new meters only. But if the Government was to specify a certain standard disc constant, would not that mean that all meters would have to conform to it, and how would we stand with our old meters when we want them tested again, when seal has expired?

MR. PRATT:—I would like to make a correction to my remarks. It is the Engineering Standards Association that I had reference to and not the Government Bureau. The idea being that any manufacturer would naturally conform to these standards. We cannot change the constants, standards of

meters and apparatus in connection therewith that we have on our lines, but I feel that we cannot start too soon to standardize our system of weights and measures.

THE PRESIDENT:—I think that meets your views, Mr. Craig?

MR. CRAIG:—Yes.

THE PRESIDENT:—A vote of thanks of the meeting is due to you.

MR. McDUNNOUGH:—If this Committee were nominated and Mr. Turley takes this up with the Secretary of the Engineering Standards Association, they would then nominate a committee and these different members could get together and probably, in a few sessions, settle everything. Both manufacturing and operating members would be represented on the Committee.

THE PRESIDENT:—Do you approve of that modification?

MR. PRATT:—Yes.

THE PRESIDENT:—It has been moved and seconded in the terms put by the proposer and since modified by agreement between the proposer and seconder. What is your pleasure? I may say that we will get this motion put into proper form and, if necessary, it will be submitted again, but I will now put it to the meeting unless you wish to discuss it. Is it your wish to approve of this motion made by Mr. Pratt? (*Carried.*)

THE PRESIDENT:—Now, Gentlemen, we are still on the point of Mr. Turley's report. Are there any more observations to be made in regard to it?

MR. GOULD:—Mr. President, I think that more attention should be paid to that part of the report regarding the bringing to bear upon the Department the changing of the length of time that meters could be in service before they have to be re-inspected. This is attended by great expense to the companies which falls eventually on the consumers. I think if it is explained to the Department by our Committee, after these tests and experiences, that this inexorable rule they have is needless and should be extended, that the Department would do it.

THE PRESIDENT:—The present period is what?

MR. GOULD:—Five years. In the report, it has been stated that after nine years a meter was in good condition, in the same pristine condition it was when installed and that the variation in accuracy of meters after five years continuous service is exceptional.

I think that this point and the point of standardization of apparatus are the two principal points brought out in the report and that if those things could be brought about, it would result in great economy to companies and to the consuming public as well.

MR. TURLEY:—I might say with reference to the extension of time, the system which exists in the United States is somewhat different from ours, and they, previous to the war, used to test their meters—that is, they were all tested in *situ*, I think once every year or at least once every two years, and one of the subjects which came up at the N. E. L. A. was the question as to whether that was really necessary. They found during the war, when they were short of men that this period had gone as high as four years and that there was very little difference in the results at the end of four years to what they found at the end of two years, and now they are seriously considering

extending it to six years. They were surprised when I told them that our experience had shown us that in five years the variations were practically nil —we had the experience of the whole of Canada—due to the fact that it was the law in Canada that they could be extended to five years. I think that probably at the next meeting of the N. E. L. A. it will be recommended that they continue their system as it is and only do their testing once every five years. Now, I think we should profit by past experience and make ours eight years.

I have every reason to believe that the period of five years originated from the old gas meter practice, and the life of the gas meter is governed by the life of the leather inside of the meter, the life of the oil in the leather which will only last about five years, and that is the basis for this five-year period. It has never been borne out on any test that we ever made on electric meters that they should be cut down to five years, and I personally believe there is more damage done in bringing a meter in at the end of five years and sending it out again; that the customer is more liable to be beaten, or the company is more liable to be beaten, by the meter jewel being scratched when the meter is brought in for the Government test, than it is by leaving it out another five years.

MR. S. L. B. LINES:—Mr. Chairman, if you are going to the Government, why not suggest doing away with the inspection altogether? There are only two countries in the world where that seal is adopted—Japan and Canada— and I think that the meter superintendent will agree that the Government inspection is really of little real value. It would seem to me that the public wants some real protection by the Government and it would be perfectly feasible to arrange for each supply company to pay say five or ten cents a year per meter installed, which would provide the necessary funds for the Government Inspectors to go around and test a meter here and there *in situ* and a penalty for each meter they find wrong. This would then put the onus of keeping meters correct on the Supply Company rather than as at the present time on the Government. It would be a great relief to get rid of the sealing system under present conditions. Meters are shipped, the standards are also shipped—they are of commercial type, not of laboratory type —and we get cases where meters are rejected when they are really accurate. I myself have proven this to the Government two or three times in the last four years. If we could put the onus on the Supply Company to keep their meters accurate, it would be more satisfactory to the Supply Company, the public and the manufacturer and, I think, to the Government.

MR. TURLEY:—In reference to that, this fighting the Government is bad business. I do not know whether all the members remember it, but we had quite an exited reply from Mr. Higman in the electric paper, to which we neglected to reply. I seriously considered replying and finally decided that all statements which we made were correct—the misunderstanding was due to Mr. Higman reading our report between the lines and misunderstanding it. But, at the same time, I think that we probably should reply eventually, but I do not think we can do it yet. The Government system is established. As far as I can see from the Blue Book it exists for revenue only, about the only use this is, and I do not think we want to interfere with the revenue department of the Government at the present time, but we do want to cut down

our own expenses in handling meters, and this suggestion which Mr. Lines makes with reference to the change in the system of sealing, I think is along the line of the American practice which I believe is a good one, and for this reason I suggested that we try to make a combination of our system and their system. But there is one advantage that the Government sealing has, and this applies more particularly to the billing and complaint department. A man comes in and complains about the meter and we are able to say, "Well, the Government tested it and sealed it and it must be all right," and it cuts down a lot of complaints and saves a lot of trouble. . That is the only advantage I can see of the Government's seal on the meter, and I do not know whether the billing department would allow us to go very far in trying to get it removed, because it is a very big item to them.

MR. D. H. McDOUGALL:—I do not pretend to know anything about meters because I am not a technical man but when you consider the development of the department of Standards at Ottawa that Mr. Higman presides over, which in the early days was grafted on the Inland Revenue Department, (which department had jurisdiction over the inspection of cigar factories and distilleries) one wonders how it has become as efficient as it at present is. The electric light and gas inspection department were thrown in as a sort of side line and their importance gradually developed so that soon the tail was wagging the dog. The electrical and gas business soon became much more important than the inspection of distilleries and cigars, perhaps not from a revenue basis but on the basis of invested capital,—I say it is a wonder they are as efficient as they are, when we remember some of the meter inspectors appointed in the early days.

It seems to me that this report is very timely and that we should use our technical knowledge to the advantage of the public and to the advantage of the companies by assisting and co-operating with the department at Ottawa to make its service to the public as efficient as possible, and also to help ourselves to the extent of removing unnecessary red tape and unnecessary cost which has arisen, due somewhat to the necessity for revenue. I think the suggestion of increasing the period of use of meters before re-testing to eight years is a good one.

We have had deputations wait on the Government from time to time, to try and get the inspection fee reduced. This is another way of accomplishing the same result. I think that the suggestion will be met by Mr. Higman quite favourably, and I think that it would be of great value to the member companies if they can get the term extended.

THE PRESIDENT:—Well, I feel we have had a most interesting discussion on this. Are there any other observations that anyone wishes to make?

MR. E. HOLDER:—In regard to the Bureau of Standards at Ottawa, I just recently visited the Bureau of Standards with some of my meters to have them tested, and I can assure the members of the Convention that the equipment of the Bureau of Standards regarding the testing of sub-standard meters is very fine. It is very, very finely equipped and seems to have a staff there which is very capable and seems to do the work quite thoroughly, and as far as that goes, the Standards Bureau at Ottawa seems to be in quite an efficient condition.

MR. McDUNNOUGH:—This time last year if I remember right, the Ontario Hydro Electric Commission were trying to approach the Dominion Government with a proposition to take over control of electric meters in the Province of Ontario. I want to know whether they got anywhere.

MR. D. H. McDOUGALL:—I think that proposal was opposed very strongly by Mr. Higman, and to the best of my knowledge we never accomplished very much with it.

MR. LINES:—On that question they were met with the British North-American Act. The Dominion Government has the right under the Act of Weights and Measures. This is weights and measures and the Provincial Government were told they had no jurisdiction.

MR. PRATT:—I would like to make an observation in confirmation of what Mr. Turley has said in connection with the extension of seals on meters. In the first place, I would like to correct an impression that the Government, in fact, are testing meters for the purpose of raising revenue. In the first place, the testing of meters was placed in the Department of Inland Revenue more for the sake of putting it somewhere than because it properly belonged to the Revenue Department, and we were assured on one visit to Ottawa that the Government did not desire to make money out of testing meters but merely to cover the cost of so doing, and if properly approached I do not think they would object very strongly to this arrangement.

My own experience is the same as Mr. Turley's. (I gave him some of the data on which he based his report): that is, meters after being out for six years very rarely vary from their initial accuracy. Our experience is that only one per cent. are slow or fast. Ninety-eight per cent. of the meters that the company put out, after being out five or six years are still correct. Now extending the period to nine years would result in a saving to our member companies of 45 cents per meter per annum. We find it costs very nearly $2.00 per meter to bring them in, have them re-sealed, cleaned and tested and put back on the lines. I think that one of the best things we could do would be, at an early date, to have our Meter Committee form themselves into a deputation to call upon the Department at Ottawa. I know that the minister has always been favourable, always inclined to treat our recommendations very favourably, and Mr. Higman, the engineer in authority for the department, is most courteous to our deputations and most willing to listen to what we have to say.

THE PRESIDENT:—We have had a very interesting discussion indeed on the subject of this report. I shall not attempt to summarize. There are one or two things which passed through my mind. It is not altogether unreasonable, I think, that we should have a longer term in this country than they have in the United States. Recent happenings in the States and possibly future happenings in November of this year would indicate that they are rather inclined to short terms.

As to the suggested approaches in reference to Government, I think it is quite likely that we shall be able, eventually, to have the matter dealt with along the line indicated by Mr. Lines. Of course we know that in dealing with the Government it is just as well to go step by step.

Unless there are some further remarks to be made I shall declare this discussion closed.

THE SECRETARY:—This discussion has brought out the fact that probably it would be well to have the Meter Committee get their data together on the question of lengthening the term, and with the approval of the Executive, be delegated to visit Mr. Higman at Ottawa and place this matter before him.

MR. HOLDER:—Before we go any further, might I correct an impression that exists. The Standards Department is not in the Department of Inland Revenue, it is part of the Department of Trades and Commerce.

THE PRESIDENT:—Yes, we did not deal with the evolution to date.

It occurred to me in regard to the proposition made by the Secretary that perhaps that could be dealt with by the Committee which is to be formed. I think it would be taken up in connection with their activities. I imagine this contemplated action is approved by those here. I understand our view generally to be that we should move along these lines just as rapidly as wisdom dictates and no more. In other words, we are glad to have such benefits as we have obtained and we hope to get more but we do not wish to jeopardize the situation.

Before closing that, would it not be as well that the Committee look into the question of this sealing so as to prevent the theft of the current, because it has got to be quite a problem now, to avoid the theft of current.

MR. D. H. MCDOUGALL:—I think, Mr. Chairman, that is a local matter with the provinces. I think it is a matter largely of the jurisdiction of the province.

MR. A. P. DOODRIDGE:—My object in speaking of Ontario is that there is that precaution taken, whereas in the Province of Quebec it is not.

MR. GOULD:—It would be a matter for the Province of Quebec to deal with.

MR. TURLEY:—My object in putting this part in the Report is to bring out discussion just as it has here. This is the law in Ontario. It is a law, I believe, just recently passed in Nova Scotia. It is not a law in Quebec, and as a matter of fact, I believe the most of us in Quebec are more or less ignorant of the operation of the law in Ontario, and I brought it up in order to let our Ontario friends give us an idea how it does operate. I made the suggestion recently to some of the companies in Quebec that we try to have this adopted. Some of them immediately said, "Why get any more laws? Why not leave it alone and let us do as we like?" I think that is rather difficult. I think if the Quebec interests would get together and compel everybody to have these sealed entrance switches, and customer bear it as part of his expense in putting in lighting equipment, it would overcome a lot of trouble we have. At the present time in Montreal, for instance, we are putting in a few but we have to buy them and then bill the customer and the only ones whom we can compel to put it on at present are those who are suspected of theft or who have been caught stealing. And if that customer moves from the place where he is to another place, we have to bill him with another one. The objection that has come up here is that if there is any law to compel them to put them in, and we compel the customer to put them in and pay for them we cannot go along and seal it; it is the man's own box and he can break the

seal to suit himself, and I would like to hear a discussion as to any difficulties.

Another matter which came up, was if you put the sealed box on the service—in Montreal we have 150,000 services;—would not your patrol department be called out continuously to renew fuses in those sealed boxes, where at the present time the customers can put in their own fuses?

Mr. Gould:—That question of the fuses is governed by the box. The box contains a master fuse which is the last one to blow and as far as I know, the companies themselves attend to this. I think this is a matter locally in the Province of Ontario, and I think it would be to the interest of the operating companies in the Province of Quebec to get together and get legal assistance, if they think it necessary, to examine the laws which have been passed by the Province of Ontario, principally at the request of the Hydro-Electric Power Commission. They have some good points in one way, and this is one. Some of their laws are very drastic but this is a good law. If in the Province of Quebec you could draft a law which you think would suit you, and submit that to the Provincial Government and show them the necessity of it in the interests of the public, the Government would pass that law and that would overcome the difficulty which you have at the present time.

Mr. Turley:—I think they undoubtedly will, but have you found any objections at all to having the box sealed? You have not found that it gives you any difficulty at all?

Mr. Gould:—No, we cannot say that we have, as far as I know. We have found that it results in benefit to the company and secures the company against theft, for one thing, and also secures the consumer against liability for damage by fire, and it is better for the public and better for the company, and where it is made a necessity by law that this installation should be made, you can bill the customer for the installation, and the company is relieved from a good deal of unnecessary investment in that way.

Mr. D. H. McDougall:—I would like to ask a question. I understand in the city of Montreal there is some rule or regulation or ancient by-law or some other enactment whereby if a customer is caught stealing current, the company has an automatic fine that it collects. Now, I think we would rather have that than the sealed services. As far as the sealed service in Toronto goes, we believe it is of little benefit to us because we find a great many of the seals broken. The customer is liable not even to put in a trouble call; he just breaks the seal; he will put in a fuse and perhaps inform you sometime afterwards, or the meter reader will report. Now, if the company does not enforce penalties for breaking the seal, then the box is not much protection. Your meter readers—who are the cheapest class of labour you have - sometimes report broken seals and it then means sending a man up to seal it again and very often a bill to the customer for a dollar or something like that for extra cost, but I do not really believe such procedure works out as well as an automatic fine would do if you had the power to impose it.

Mr. Turley:—Why not impose automatic fine for breaking seal and collect more?

Mr. D. H. McDougall:—You have to have the man arrested and brought into court and prove he has broken the law and in doing that the company gets no financial benefit, and its men have to go to court and lose

time, as well as involving a quarrel with your customer and it is a nuisance. It is much better, unless we have evidence that the man has stolen a considerable amount of current, to let the thing go.

MR. TURLEY:—We still have an automatic fine. We would have an additional chance.

THE PRESIDENT:—It seems to me that this matter is really a Provincial matter and a mixture of law and other things. As the situation presents itself to my mind it is largely as indicated by Mr. Gould, modified, of course, by these observations made by Mr. McDougall.

I should like to say (lest anything I said before should be misunderstood), we all quite appreciate what has been alluded to by more than one speaker --I think, amongst others, by Mr. Pratt and Mr. Holder— to the effect that from Government officials whom we have had to deal with, we have always received courteous treatment.

MR. DODDRIDGE:—I would say the committee in interviewing the Government would bring this question up in regard to Quebec. When interviewing the Government they might bring this up also and see what could be done in that way.

THE PRESIDENT: Doubtless, such of the members of the committee as are here—Mr. Turley and his confreres, will bear it in mind.

I think Mr. Dunlop is not here, so the next paper is a paper by Mr. Svenningson on Report of Committee on Prime Movers. I will ask Mr. Doddridge to take the chair while I am out of the room.

Mr. A. P. Doddridge takes the chair.

REPORT OF COMMITTEE ON PRIME MOVERS—1920

INTRODUCTION

Your committee in drawing up this report have endeavored to present the information secured in as compact and condensed a form as possible.

The report covers steam and hydraulic turbines as well as oil engines, but in view of the importance of hydro-electric developments in Canada, more time has been devoted to the question of hydraulic prime movers, and the data pertaining to steam turbines and oil engines is therefore of a rather limited nature.

Considering that of the electric power developments in Canada, between 85% and 90% of the total power developed is hydro-electric, your committee therefore have felt justified in giving the most of their attention to the hydraulic section of this report.

STEAM POWER

The present day tendencies are still towards higher pressures and temperatures, the concentration of power and large unit capacities.

BOILERS

We have nothing new to report on the development in boiler design and construction. We regret, also, not having any data to present in connection with stokers, grates, economizers, condensers and various auxiliaries.

STEAM TURBINES

Owing to the high price of fuel, the efforts of the manufacturers have been directed to the development of turbines along the line of improved economy.

Large single cylinder turbines have, in a number of cases shown a marked economy in operation.

Units of large capacity and high efficiency are still favored by large operating companies.

The success in economical operation of steam turbines will of course depend upon the careful selection of auxiliary apparatus.

COAL AND ASH HANDLING EQUIPMENT

We have nothing new to report on the question of fuel and ash handling.

INSTRUMENTS, ETC.

We regret having no information on meters, indicators, instruments, etc.

FUEL OIL

Considerable progress has been made in recent years in the use of fuel oil in place of coal.

Insurance companies regard the fire risk as considerably greater with fuel oil than when coal is burned. Consequently, when considering the installation of oil burning equipment in place of coal-burning apparatus the require-

ments of the insurance companies and fire underwriters must be carefully considered as well as the ordinary question of cost, efficiency, etc.

Engineers interested in the use of fuel oil claim there is no more liability to fire than when coal is employed.

Chief advantages of fuel oil are cleanliness, reduction in attendants and absolute control of the fire.

OIL ENGINES

The Diesel Engine has been built during the past year up to 520 B.H.P. 4 Cycle, and up to 3,300 B.H.P. 2 Cycle.

As the fuel consumption of the Diesel Engine is practically uniform, its advantages in fuel costs are more apparent in small sizes. The fuel consumption of Diesel Engines is now guaranteed at .4 to .5 lbs. per H.P. per hour at full load, and .5 to .6 lbs. per H.P. per hour at half load. This represents a thermal efficiency of 34 per cent. and is about one-third the consumption of an oil-fired steam plant of the same size.

HYDRAULIC TURBINES

Wheels have been installed in sizes up to 40,000 H. P. and there are indications that the limit in size has not yet been reached. This practice has been made possible by the enormous growth of distributing systems, and by the parallel operation of adjacent networks. Higher efficiency is obtained from such installations, one consulting engineer, Mr. B. F. Grouat of Pittsburgh, U. S. A., reporting over all efficiency of 90% for such units, reckoning from the mechanical energy of the water to the electrical energy on the bus.

Whilst the present tendency has been towards the use of vertical turbine units, which are undoubtedly more efficient when mounted, there are cases where horizontal turbines are still required to operate pulp grinders, etc.

A new type of high speed runners has been developed; this type of runner will undoubtedly be very useful in plants of low head.

There is a tendency to have the generating units outdoors, housing only the control apparatus.

Manufacturers report a continued tendency to install automatic hydro-electric plants.

Wheels have been constructed with the speed rings made so that hot water could be circulated therein, and then through the guide vanes, in order to prevent the formation of frazil ice. No data is available yet as to the performance of these wheels. Mr. Murphy, of Ottawa, has exhibited during the year moving pictures, showing the formation of frazil ice in experiments made by him, and has done much to interest engineers in this subject, which is of paramount importance to those who are operating hydro-electric plants in Canada, and the northern parts of the United States. There has been much discussion on the ice problem, the general opinion being that these difficulties can to a large extent be obviated by: (1) Drowning out rapid above the power site; (2) Locating the development so that the prevailing winds tend to drive the ice away from the forebay; (3) Heating the racks and runners slightly above the temperature of the

surrounding water; (4) Keeping careful log of weather and ice conditions, and of their relation to each other.

The Kingsbury, Gibbs, and other forms of thrust bearings have been used during the past year on very large units and have given satisfaction.

Manufacturers report improvements to their governors. The practice with regard to auxiliary oil and water pumps has been divided between installation of such apparatus as a unit attached to each generator, and the use of one or more centralized systems with main distribution.

Your committee has recently received letters from member companies advocatng a closer co-operation between Canadian Electrical Association and the National Electric Light Association.

(*a*) MONTREAL LIGHT, HEAT & POWER CONSOLIDATED

MONTREAL, MAY 31, 1920

MR. S. SVENNINGSON,
Chairman, Committee on Prime Movers,
Canadian Electrical Association,
Power Building,
Montreal, Que.

DEAR SIR:—

As you are Chairman of the Prime Movers Committee of the Canadian Electrical Association I take the liberty of writing you in the matter of the work of the Prime Movers Committee.

Do you not think that as good results could be obtained for Class "A" members of the Canadian Electrical Association from a representative of the Canadian Electrical Association acting on the Prime Movers Committee of the National Electric Light Association? Duplication of work would be avoided and it would be more economical, as the practice followed in Canada is largely governed by the U. S. standards at the present time.

Yours truly,
(SIGNED) R. M. WILSON, *Chief Electrical Engineer.*

(*b*) SOUTHERN CANADA POWER COMPANY, LIMITED

MONTREAL, MAY 17, 1920

S. SVENNINGSON, ESQ.,
Chairman, Committee on Prime Movers,
Canadian Electrical Association,
Power Building,
Montreal, Que.

DEAR SIR:—I have seen the report of the Committee on Prime Movers of the National Electric Light Association, of which you have the honor to be a member. It is very complete, and could only have been made by a

large committee, having available a wide field of information.

Would it not therefore be beneficial to the Class "A" members of the Canadian Electrical Association, and would not much duplication of effort be avoided thereby, if we were represented on the various committees of the National Electric Light Association, instead of acting independently as at present.

I remain,

Yours very truly,

(SIGNED) JAS. B. WOODYATT, *General Manager.*

(c) THE SHAWINIGAN WATER & POWER CO.

MONTREAL, MAY 21, 1920.

MR. S. SVENNINGSON,
Chairman, Committee on Prime Movers,
Canadian Electrical Association,
Power Building,
Montreal.

DEAR SIR:—It seems rather useless that there should be a duplication of effort on such an important matter as Prime Movers. I understand that the Canadian Electrical Association as such, has a committee on this subject and is working more or less independently of the National Electric Light Association. I further understand that you are a member of the National Electric Light Association Committee on Prime Movers.

It seems as though the most economical method as regards time and effort, which would give better results, would be to have the Canadian Electrical Association represented on the committees of the National Electric Light Association in these important matters where the standardization of this type of apparatus must necessarily conform very largely at least, to the U. S. standards.

Very truly yours,

(Signed) JULIAN C. SMITH, *General Manager.*

MANUFACTURERS' STATEMENTS

CANADIAN WESTINGHOUSE COMPANY.
Re Steam Turbines.

The Canadian Westinghouse Company report that the following installation of large turbo-generator units of 2000 kilowatt capacity and above have been made in recent years.

Cleveland Electric Illuminating Co.	25,000	K.W.	—60 Cycle.
Brooklyn Edison Co.	30,000	"	—25 "
Transit Development Co. of Brooklyn	30,000	"	—25 "
Narraganset Electric Light Co.	45,000	"	—60 " Cross Compound
Duquesne Light Co.	45,000	K.W.	—60 Cycle
Duquesne Light Co.	60,000	"	—60 " 3 Element
Air Nitrates Corporation, Muscle Shoals, Alabama	60,000	"	—60 Cycle
Interborough Rapid Transit, New York	60,000	"	—25 " 3 Element
Interborough Rapid Transit, New York Three	30,000	"	—25 Cycle 3 Element
Commonwealth Edison Co., Chicago, Two	35,000	"	—60 Cycle Tandem
Commonwealth Edison Co., Chicago, One	35,000	"	—25 Cycle Tandem

In addition to the above the following quotation is given from one of the Westinghouse publications, outlining the progress in the design of steam turbine equipment during the year 1919.

"A notable installation is the 70,000 K.W., 25 cycle, 3 element cross compound unit, placed in service during the past year at the 74th Street Station of the Interborough Rapid Transit Co., of New York City. The unit is rated at a capacity of 60,000 K.W. continuously, or 70,000 K.W. for two hours and is therefore the most powerful primemover in the world.

It has three elements, one high pressure and two low pressure and it is the first triple-cross compound turbine to be placed in operation. The purpose of this huge machine is to assist in meeting greatly increased demand for transportation in New York City, due to the opening up of a new subway system and the extension of the service of the existing subway, elevated and surface lines.

The new unit occupies a floor space of 52 by 50 feet and is about 19 feet high. The high-pressure element receives steam at 205 pounds gauge-pressure and superheated 150 degrees Fahrenheit and exhausts it into the

low-pressure elements at 15 pounds gauge-pressure. The two low-pressure elements are identical in construction and each receives half of the steam from the high-pressure element and exhausts it into the condenser where 29 inches vacuum is maintained. All three elements operate at 1,500 R.P.M. and each drives a generator rated at 20,000 K.W. continuously, 23,500 K.W. for two hours and 30,000 K.W. for a half hour. The generators deliver three phase 25 cycle, 11,000 volts alternating current.

Another especially notable turbine unit similar in design and capacity to the one just described, but for 60 cycle current was installed at the U.S. Nitrate Plant No. 2. at Muscle Shoals, Alabama. This unit was secured by the government and shipped to Muscle Shoals for the purpose of producing nitrates used in the manufacture of gunpowder. In this case the high-pressure element operates at 1,800 R.P.M. and the two low-pressure elements at 1,200 R.P.M. The three generators are of the same capacity.

A new application of the turbine is in the role "House Turbine" which is now assuming an important place in large power stations. This is exemplified at the United States Government Nitrate Plant in a 2,500 K.V.A. non-condensing 3,600 R.P.M. unit, the exhaust of which is used to heat the feed water. Just enough load is placed on the unit to obtain the desired heat balance.

GENERAL ELECTRIC COMPANY, SCHENECTADY

RE STEAM TURBINES.

1. There have been no changes in capacity and types of turbines from those developed in 1918.

There is a turn towards an increase in steam pressures and temperatures. 250 pounds pressure and 200 degrees Fahrenheit superheated is fairly representative of present practice, detailed changes in steam packings, greater use of steel to meet high temperature conditions, straight oil-cooled bearings instead of combined oil and water show the turn of present developments.

2. By a change in the design of high-pressure shells, the high-pressure vertical joint has been eliminated in each turbine. Lagging has been simplified so that it can be removed in sections. Exhaust hoods have been increased in rigidity by making them heavier and by the addition of ribs. Wheel surfaces have been made smoother and all holes through wheels reamed and rounded at the edges. Balance-weight wheels have in some cases been entirely eliminated and balance-weight grooves in the wheel rims substituted. Radial clearances outside of wheel reams have been increased. Provision for inspection without removing top half of wheel casing. Also, there is a general tendency to increase all wheel clearances.

3. The production of castings by the centrifugal process is still in the research stage. Work along these lines is being very actively prosecuted but we do not yet know the degrees of satisfaction that may be expected from this method of making castings.

4. With regard to the standard operating practice in regard to the starting up of turbines of 15,000 K.W. and larger, the time required to start turbines depends on the temperature of the machine, the steam conditions and size and type of turbines; all of these factors vary between wide elements.

In general, the time taken to start goes up with the size of the unit and it is limited by heat distortion in the turbine while coming to a suitable condition. It is better to allow the turbine to warm up while turning over slowly than to permit heating up with packing steam only. Further than this, experiments with each turbine must be the determining factor with the time required to start.

Various designed features are under investigation which have for their fundamental purpose the avoidance of distortion during the period of heating up, thereby reducing the time taken to start up from a cold condition. We are now giving more specific and advantageous instruction in reference to starting than has been our general practice in the past.

5. In reference to balancing of machines, both static and dynamic methods of balancing are in factory use, these varying with the size and type of machine. With a combination of these methods it is found practicable to obtain balance sufficiently good so that very few rotors require subsequent balancing when same are in the factory tests. A balancing machine in the power house or large central station, we would consider unnecessary.

6. With regard to reduction gears, forced lubrication and cooling of oil are required when the work becomes heavy, as in any high speed rotating machinery it is absolutely essential that rotating parts be properly balanced.

7. As regards the best practice in the method of connecting steam line to turbine throttle and of anchoring and supporting steam line, the turbine throttle valve may move from one-quarter inch or one-quarter inch to three-eighths inch in a horizontal direction due to heat expansion, and piping should be so anchored as to permit this movement without excessive force being transmitted from the piping to the turbine. The method of fulfilling these conditions will be dependent upon the arrangement of piping most convenient for any specific installation.

8. With reference to operating temperature of oil in the bearings, when the oil temperatures are too low, the bearing losses are excessive; when too high, the oil deteriorates. In our judgment, temperatures from 140 degrees Fahrenheit to 160 degrees Fahrenheit, represent conservative practice for temperature of ordinary oil as measured coming out of the bearings. We are not in a position to make specific recommendations for separators and purifiers, one or both of which are desirable to keep oil in good condition.

9. Turbine casings and shells have had flanges increased in thickness to permit more substantial bolting and special attention is being given to the joint fits.

Emergency governors for large horizontal turbines can be furnished with springs to reset at 1% to 2% above speed and drop out at 6% to 8% above speed, thereby making it unnecessary to lower the turbine speed below synchronism to reset the emergency.

The automatic vacuum breaker is an asset when located on the condenser in such a way as to prevent cold air hitting any part of the turbine rotating elements. It is of particular importance where there are long exhaust connections to the condenser. Over-speed tests only to a point sufficient to trip the emergency are recommended.

We consider the use of atmospheric relief valves good practice and require their use on large turbine installations. To what extent this practice should be extended might well be a subject for discussion. With the high degrees of super-heat generally used, it becomes necessary to avoid slugs of water coming into the turbine as there will be a great difference between the superheated steam and the water, thus causing strains and distortion to the shell, resulting in leaky joints. No construction of shell or bolting will stand such conditions.

10. Where conditions require a turbine to be motored, vacuum must be maintained and steam in sufficient quantity to prevent excessive heating and still not enough to run the turbine away must be supplied. For this purpose we recommend a by-pass valve around the throttle. For a 20,000 K.W. turbine this by-pass would consist of a one-inch pipe and valve.

The protection of blades when the unit is standing idle is the subject of active study and investigation. We are not ready to make definite recommendation at this time.

In this connection some thought has been given to the practicability of admitting hot air into the high pressure packing casing and maintaining a vacuum for an hour after the machine has been shut down in order to thoroughly dry out the turbine. To be effective this will require auxiliary steam valves in the main piping as it will be difficult to maintain throttles sufficiently tight to prevent steam leakage. The air might be heated by passing through a cylindrical space surrounding 10 or 15 feet of the steam piping before being conducted to the inlet to the high pressure packing. It is necessary to exercise great care in carrying out a plan of this kind in order to absolutely prevent the admission of cold air to the turbine.

11. During the year 1919, there were installed and put in service 235,000 K.W. total capacity of turbine generators of 20,000 K.W. capacity and larger.

THE BOLINDERS COMPANY

We have for a number of years given careful attention to the internal combustion engine for electric lighting plants. There are a number of notable power plants furnished with our engines throughout the world. Including marine engines, there are about 650,000 B.H.P. Bolinder engines in use at the present time.

The Bolinder engine is of the two-stroke cycle, surface ignition type. The working cycle is briefly as follows:—(Fig. 1. When the piston "A" at the end of its outward stroke is moving in towards the ignition chamber "E" the necessary air for scavenging and combustion is drawn through the air valves "B" into the enclosed crank case, and at the same time the air in the cylinder "D" is being compressed.

When the piston "A" has reached its extreme inward position, a certain amount of oil is injected into the ignition chamber "E" through the nozzle "F" and the fuel charge ignites, resulting in the expansion of the gasses driving the piston outward towards the shaft.

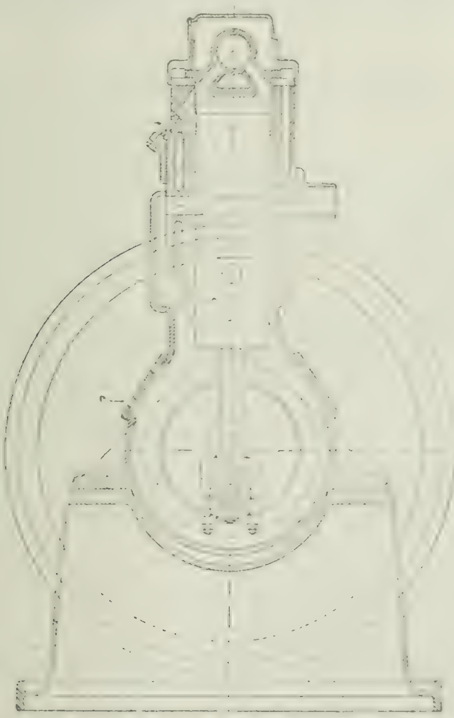
During this outward stroke of the piston, the air in the crank case is compressed. As the piston nears the end of its stroke, the exhaust port "G" opens, and immediately after, the inlet port "H".

The burnt gases escape through the exhaust port "G" while the compressed air in the crank case entering the cylinder by the port "H" completes the scavenging work, and furnishes the cylinder with air necessary to make up the next charge in the cylinder.

The rate speed varies from 325 R.P.M. for the smaller units to 180-225 R.P.M. for the larger units.

The stationary types are built in the following sizes:

1 Cylinder Engine, from 20 to 80 B.H.P.
2 Cylinder Engine, from 40 to 160 B.H.P.
4 Cylinder Engine, from 80 to 320 B.H.P.



SECTION OF BOLINDER ENGINE, FIG. 1

The maximum power developed per cylinder is, therefore, 80 B.H.P. Our Marine Engines are built in units up to 500 B.H.P., developing a maximum power of 125 B.H.P. per cylinder. The larger marine engines are furnished with an air Compressor, for atomizing the fuel oil at a pressure of 150 pounds. The stationary engines, on the other hand, require fresh water injections, same quantity of water as oil being needed.

The guaranteed maximum fuel consumption of the larger units is about 0.6 lbs. per B.H.P. per hour, based on light residue oil, or equivalent, having a specific gravity not exceeding .880, containing at least 18,000 B.T.U. per pound.

Satisfactory results, however, have also been obtained by the use of heavier oil, such as California Fuel Oil, 26° Beaume, 0.9 specific gravity, containing as high as 25% asphalt. The actual fuel consumption is, as a rule, considerably less than stated above, and in a number of installations, of which careful records have been kept, not more than 0.45 pounds per B.H.P. per hour.

The prominent features of the Bolinder engine are its extreme simplicity and accessibility. As a result the engine can be operated with only the ordinary care and attention given a steam engine. The working pressure in the cylinder is only one-third of that of a Deisel engine, and as a consequence the maintenance charges are less than for a full Deisel engine.

THE WILLIAM CRAMP & SONS SHIP & ENGINE BUILDING CO.

PHILADELPHIA, MARCH 16, 1920

I am in receipt of your letter of the 8th inst. requesting some general information with regard to the activities in the hydro-electric field during the year 1919, and the prospects for the coming year, this information being desired in connection with the Prime Movers Report for the Canadian Electrical Association.

In this connection I beg to advise that during the early part of the year 1919, there was not much activity in the hydro-electric line but during the latter part of the year there were quite a number of contracts placed. The indications for the year 1920 are that it will be a very big year, and all the turbine manufacturers are looking forward to a very busy time.

The general tendency in recent years is of course to go to large capacity units. The units just installed in the Hydraulic Plant of the Niagara Falls Power Company are an example of this. They are of the vertical shaft, single-runner type, each unit being designed for 37,500 horse-power under a head of 213 feet. Two of these units are now in operation and the installation of the third unit is almost completed. These particular units are about 50% larger in capacity that any units previously built. The tendency however to go to still larger units is shown by the fact that the Hydro-Electric Power Commission of Ontario have just awarded to our Company the contract for three vertical shaft units each to have a capacity of 55,000 horse-power under a head of 305 feet. It is thus seen that these units are nearly 50% larger than the Niagara turbines in capacity. It is, of course, true in both of the above cases that the total development of which these units form a part, are very large and therefore, from an operating point of view, it is feasible and practicable to install large size units.

With regard to the question of speed, there is no doubt whatever that higher specific speeds will be used in the near future. For low-head installations, high specific speed is of great importance as it reduces the size of the turbines, generators, and power house, and hence decreases the cost of the developments. Considerable advances have already been made in the design of high speed runners but the main difficulty is to obtain high efficiencies along with the high specific speed, and this point is being very care-

fully studied in connection with experiments being made in our testing laboratory.

The question of draft tube design is closely connected with the design of high speed runners, for with this type, the amount of energy to be regained in the draft tube is very large and hence the design of draft tube is a very important factor. Mr. L. F. Moody, Asst. to our Vice-President, has developed a design of draft tube for use in connection with high speed runners which has proven to be very efficient. This is a straight tapering tube spreading into a large diameter at the bottom of the tailrace and having at the center of the bottom, a concrete cone for turning the water. This type of tube has been installed in the new hydraulic plant of the Niagara Falls Power Company.

Regarding governors, we have made quite a number of improvements in different parts of the governor mechanism. One of the principal improvements we might mention, is the installation of small Johnson control valves in the governor base in place of the usual gate valves which have been used in the past. These Johnson valves are operated hydraulically. A similar set of smaller valves are installed with the hand control stand. Therefore, in changing over from governor to hand control or vice-versa, it is only necessary to push a lever handle which simultaneously closes the valves in the governor stand and opens the valves in the hand control stand. This is an important advantage over the old method whereby three or four large gate valves had to be closed on the governor stand and three or four smaller valves opened on the hand control when changing over. There have been a number of other smaller changes made in our governors to simplify their operation and make these machines as nearly as possible fool-proof.

With regard to the question of making provision for heating the speed rings, guide vanes, and other parts of the turbine in contact with the water, beg to advise that we have never been requested to build any units with such provisions, but do not see any reason why something along these lines could not be accomplished.

THE WM. CRAMP & SONS SHIP & ENGINE BLDG. CO., PHILADELPHIA

List of principal hydro-electric turbines completed or under construction since January, 1919:

Washington Water Power Company, (Long Lake Station, Washington).
1—22,500 HP turbine, head 168′, speed 200 RPM.

International Paper Company, Niagara Falls, New York:
2—5400 HP turbines, head 130′, speed 300 RPM.

Niagara Falls Power Company, Niagara Falls, New York:
2—37,500 HP turbines, head 213.5′, speed 150 RPM.

Great Northern Power Company, Fond-du-Lac, Minnesota:
1—15,000 HP turbine, head 355′, speed 360 RPM.

Cienfuegos, Palmira & Cruces Elec. Ry. & Pr. Co., Cuba:
2—9,000 HP turbines, head 475', speed 600; RPM.

Hydro-Electric Power Comm'n of Ontario, Cameron Falls, Ont.:
2—12,500 HP turbines, head 72', speed 120 RPM.

Androscoggin Electric Company, Lewiston, Maine:
1—2,400 HP turbine, head 31', speed 120 RPM.

The Great Lakes Power Company Limited, Sault Ste. Marie, Ont., Can.:
3—2,400 HP turbines, head 18', speed 65.2 RPM.

The Parr Shoals Power Company, Columbia, South Carolina:
1—3,600 HP turbine, head 35', speed 100 RPM.

All of the above turbines with the exception of the 22,500 horse-power turbine for the Washington Water Power Company are of the vertical shaft, single runner type. This unit is of the horizontal, two-runner type which was necessarily adopted owing to existing conditions. We point this out as indicative of the tendency towards the adoption of the vertical shaft type of unit.

The first of the 37,500 HP turbines for the Niagara Falls Power Company, cited above, was just recently placed in commercial operation and develops at full load, aproximately, 40,000 horse power; this represents the greatest unit capacity that has yet been developed in the hydro-electric field. These turbines are provided with Moody's Spreading Type of Draft Tube. This type of tube represents a very great improvement in draft tube design, particularly where there is a large amount of energy to be regained at the discharge from the runner.

THE WELLMAN-SEAVER-MORGAN CO.

The hydro-electric business is very active at present in all sections of this country, Canada, France, Spain, Italy and Japan. New Zealand is also coming in with inquiries. The Japanese are now inquiring for larger units up to 15,000 h.p. capacity, and are being converted to the vertical single-runner type.

We have from ten to twenty inquiries stacked up ahead of us most of the time, and cannot see any let-up in sight.

The installations of special interest contracted for in 1919 are the 800-foot head proposition for the Southern California Edison Co., on Kern River, where it was decided to use reaction turbines—the highest head attempted for this type; and the 1000-foot head development of the Great Western Power Company on Feather River, where it was decided to use impulse turbines; together with the Niagara Development which are the largest units to be built. The Pelton Company was awarded the contract for the Kern River Units, and Allis-Chalmers the Great-Western impulse wheels.

The San Joaquin Power Co. have two developments to be started on the Kings River where each head will be 2500 feet — the highest attempted in the country.

The large turbine for the Niagara development now on order with us, will give 61,000 h.p. at full gate, and 50,000 h.p. at maximum efficiency. We are shipping two 22,000 h.p. turbines to the city of Los Angeles to go in on the aqueduct under 515-foot head. There is also on order 8 concrete spiral casing turbines and two 15,000 h.p. cast iron spiral casing turbines under 200-foot head. The latter job is for the Pacific Gas & Electric Co., where they will have a transmission line of about 250 miles.

We have reached a specific speed of 175 and have started building a testing flume of our own to carry out further tests, especially on high speed runners.

I have recently made a study of high efficiency gearing, such as is used for steam turbines, to apply on hydro-electric units in order to cut down the cost of the generator for extremely low-head installations. It was found that the over-all efficiency could probably be increased about 1% or 2% due to the greater efficiency of the higher speed generators notwithstanding the loss of 2% in the gearing. However, the gearing cost was so high that no saving could be made except in large capacity units of around 10,000 h.p. In any case the introduction of another set of moving parts with the attendant maintenance charges and increased risk of shut-downs took all of the attractiveness out of the proposition.

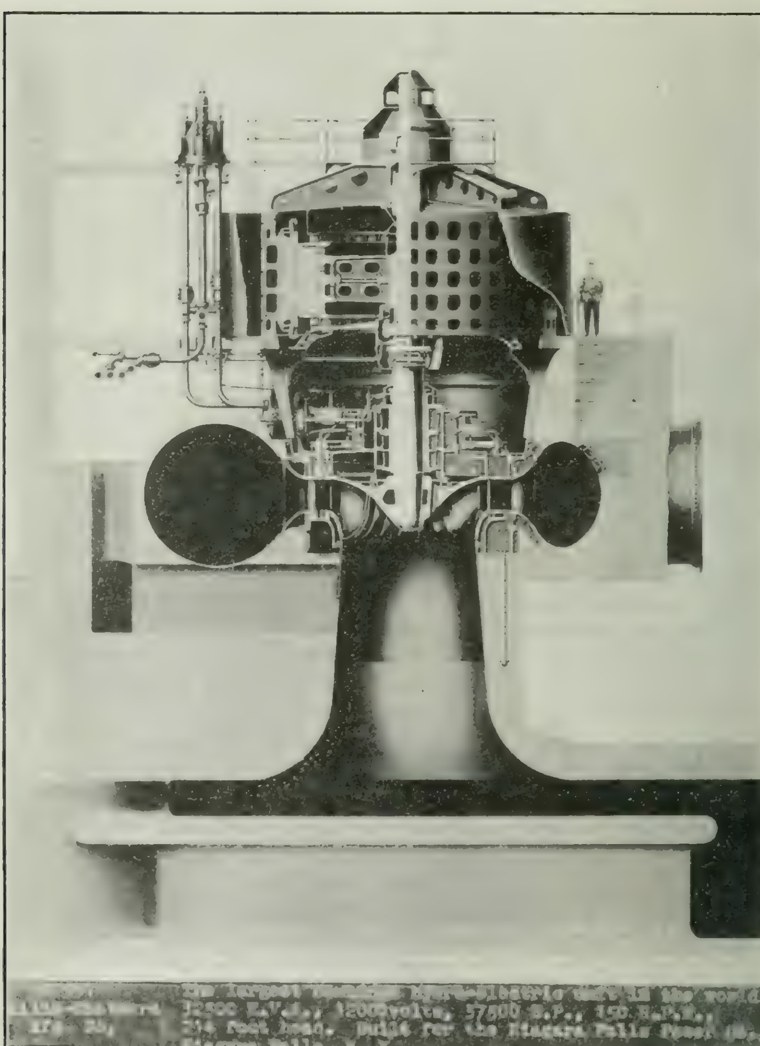
We conducted a series of tests at Holyoke the past summer on straight conical draft tubes, and find them very well adapted for small turbines. At our own shops we tested curved concrete draft tubes to determine the proper flare and contour, but are not in position to make this information public.

As yet we have not built any unit where any of the turbine parts were steam-heated, although I have heard of one such installation in Canada. The single vertical units as now used are generally large enough so that ice around the gates is not so troublesome. We keep all the operating mechanism out of the waterways and believe the best solution is to use large enough units so that the water passages through runner and gates will pass the most troublesome ice.

ALLIS-CHALMERS MANUFACTURING COMPANY

The general trend of development during the year of 1919 is covered most concisely in letter, which we wrote to Professor Allen, covering the period in question. This covers the past year in considerable detail, both as to extent and character of the work and general trend of the art and new developments. The most outstanding new type is that covered in the December number of the journal of the American Society of Mechanical Engineers, which was commented upon further in the Technical Press, particularly Engineers News of February 5th, and Electrical World of about the same date.

As to improvements in draft tubes would advise that the principles of White's Hydraucone regainer is the basis of what will probably be the greatest development in draft tube construction.



(Fig. 2)

As to governors would advise that the best example of most recent development is contained in the unit which we installed at Niagara where the direct connected flyball shows up to greatest advantage. The elimi-

nation of auxiliary drives and the great increase in dependability derived therefrom can hardly be over estimated. Photograph 89331 of the Niagara Unit is a pertinent illustration of its utility. (Fig. 2.)

We have not built any units with provisions made for heating any of the working parts in contact with the water. We have made a good many studies of such heating devices, supplying same to the guide vanes, shifting rings and main bearing.

Prof. C. M. Allen, December 29, 1919.
Worcester Polytechnic Institute,
Worcester, Mass.

Dear Sir:—Your letter of December thirteenth is at hand and we will endeavor to outline briefly some of the things that occur to us as being of interest for the report which you have in mind.

One of the most outstanding features of our hydraulic work has been the large number of big capacity units which have been placed in operation. For actual figures we have just totalled very nearly one-quarter of a million KW. in large hydro-electric generators (over twelve thousand KW. each), started in the last year. This is of interest in that it covers the products of only one company. It is not in any way an indication of the total installed capacity as there is a tremendous volume of business in machines of capacities under 12,000 KW. each but the magnitude of the capacity installed above this limit is of exceptional interest and indicates an unusual tendency toward hydro-electric practice.

As to large machines and specially designed units can only state that the performance of the 31,000 HP. units in the Narrows or Badin Plant of the Tallahassee Power Company has been very gratifying, and has naturally been one of the factors contributing greatly to the general adoption of large capacity units.

Bearing on the performance of the Badin Plant, which is so radically a pioneer in the big capacity field, would quote as follows from a letter received from Mr. Rickey:

"As recently requested by you, I looked up the operating records of our Narrows Power House and find that the continuity factor for the year 1918 was 99.992. The small difference between the actual factor of operation and the factor for perfect operation, which would be 100%, was caused by conditions foreign to the turbines and generators; in other words, insofar as the turbo generator units were concerned, their operation was 100% continuous.

You will recollect that at the time of ordering the turbines, I told you they must be of the "Ivory Soap" variety, by which I meant that their operation should be "99.44% pure". Inasmuch as you have exceeded the percentage claimed by the Ivory Soap Manufacturers, we will have to adopt different nomenclature to accurately define the particular brand of turbines installed in our Narrows Development.

I take this occasion to congratulate your company and also yourself, on the very satisfactory operation obtained from the turbines and generators you installed in our Narrows Power House."

This is a very remarkable performance in view of the wide departure from precedent, which might have served for more or less of an excuse for interruption due to unforseen contingencies.

During the last year the second plant of the Tallahassee Power Company, embodying three 27,000 HP. wheels under 188 ft. head was put in operation without a single hitch. This plant as well as subsequent plants such as that of the Niagara Falls Power Company at Niagara Falls, New York, showed very strikingly the progress that has been made in the order of designing and building complete hydro-electric units and emphasises particularly the advantage of having them built by one company. The machinery in these two plants was assembled completely, including turbine, governor, generator and thrust-bearing, and after completion and final inspection the unit was pronounced ready for service and without any delay for adjustment of governor, governor connections, thrust-bearing or turbine. The machine was started from a push button on the switchboard, brought up to speed put on the governor and on automatic regulation basis without the necessity of any adjusting during the process. This is something entirely new in the initial operation of large prime mover machinery and was the occasion of considerable comment at the Niagara Plant of the Hydraulic Power Company.

As to some of the larger plants which typify the developments of the last year, would cite the following as having been put in operation or being well along in construction:

Tallahassee Power Company (Cheoah Plant), Tennessee.
Three—27,000 HP. 188′ head, plate steel spiral-cased vertical shaft units with direct connected flyballs.

Wateree Power Company, South Carolina:
Five—17,500 HP. 68′ head single runner vertical shaft concrete spiral-cased units.

Puget Sound Traction Light & Power Co, Washington:
One—25,000 HP. 465′ head, horizontal shaft cast steel spiral-cased type.

St. Lawrence Transmission Company, North Carolina:
Two—11,000 HP. 258′ head, vertical shaft cast iron spiral-cased type with direct connected flyballs.

Eastern Michigan Power Company (Foote Development), Michigan:
Three—4630 HP. 35′ head units, single runner vertical shaft concrete spiral-cased units with direct connected flyballs.

Niagara Falls Power Company, Niagara Falls:
One—27500 HP. 214′ head, vertical shaft plate steel spiral-cased type with direct connected flyballs.

San Joaquin Light & Power Corp., California:
Three—15,000 HP. 315′ head, vertical shaft single runner, cast steel spiral-cased units with direct connected flyballs.

Great Western Power Company, California:
Two—30,000 HP. 1008′ head, double runner overhung type horizontal impulse wheels.

The above applies particularly to large capacity developments which are of possibly the greatest interest. The biggest effect of improvements which have been pushed considerably during the last year can be found in connection with the small capacities and lower head developments and is based on the high speed runner which was covered in our contribution to the American Society of Mechanical Engineers, copy of which paper you have available. You are at liberty to use that subject matter in any way you wish.

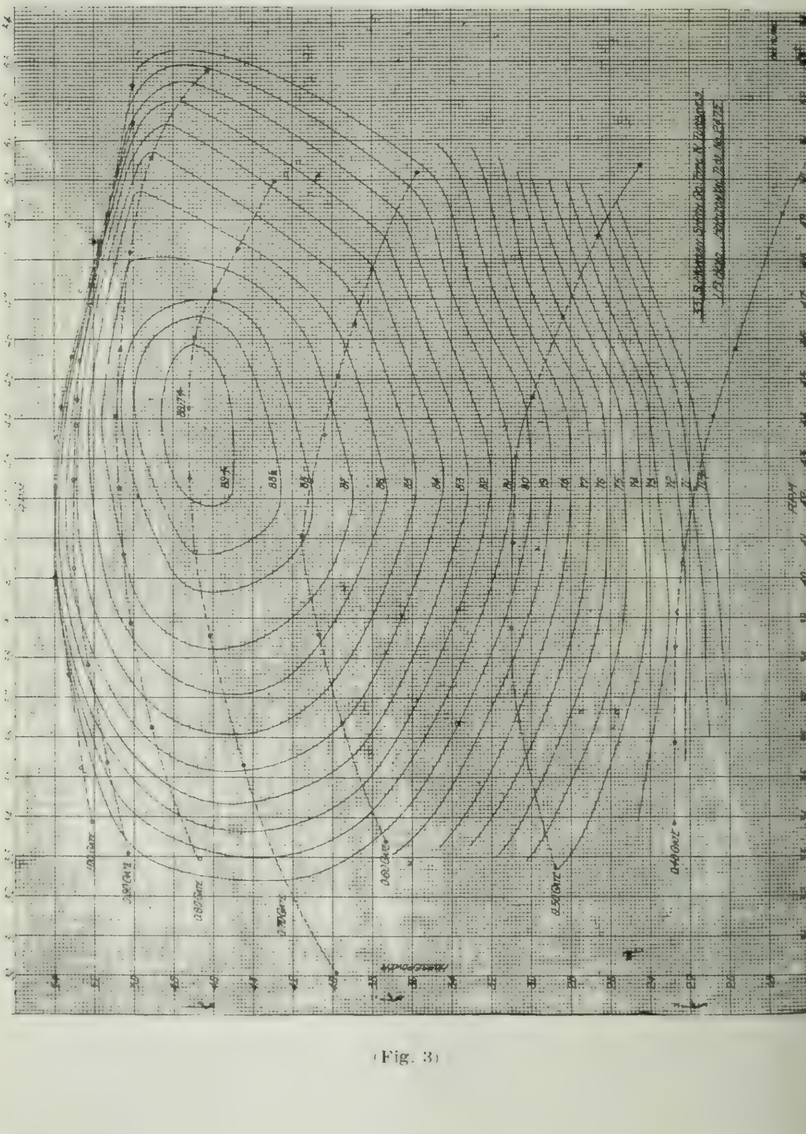
As to tests would advise that salt solution test on the large capacity unit at Badin Plant of the Tallahassee Power Company indicated a maximum turbine efficiency of 94%, allowing a generator efficiency of 97%, which we believe is a record as it was based upon volumetric test by the salt solution method and not upon any weir or current meter tests.

COMPARATIVE TEST ON VERTICAL AND HORIZONTAL RUNNERS BY S. MORGAN SMITH CO.

The attached results of tests made in the Holyoke flume shows that there is very little difference in the characteristics of turbines, whether operated in a vertical or horizontal setting, provided that the approach and discharge passages have been properly designed. The tests were made on 33" type N Turbines, built by the S. Morgan Smith Co., of York, Pa. The table shows the results of the tests: Test No. 2310 being for the runner in a vertical position, and test No. 2475 being for the pair of runners in a horizontal setting. In order to show the results in a convenient form, equal efficiency curves have been plotted after bringing the test data to 1-foot head. (Figures 3 and 4). The speed at 1-foot head corresponding to 187.5 R.P.M. at 18 ft. head the conditions under which the specifications called for the maximum efficiency was 44.2 R.P.M. An inspection of the contour curves shows that the runner when tested vertically slightly exceeded this speed, and that the pairs of runners when tested horizontally developed the maximum efficiency at almost exactly this speed.

The difference between the vertical and horizontal tests under the normal head of 18 feet is shown in Fig. 5. A difference of about 1% was obtained in favor of the vertical setting.

The efficiencies of the horizontal turbines at 75% and 50% of full gate was less than the corresponding efficiencies of the vertical setting, but the reduction was small, ranging from 3% to 1.8%. The range in speed was the same for the two types of setting. The range in power at good efficiency was somewhat less for the horizontal than for the vertical setting. In general, the difference of speed, power and efficiency from the two types of setting was small; smaller than has usually been expected. The tests show that an efficiency of 90% for low head horizontal turbines is not an impossibility.



(Fig. 3)

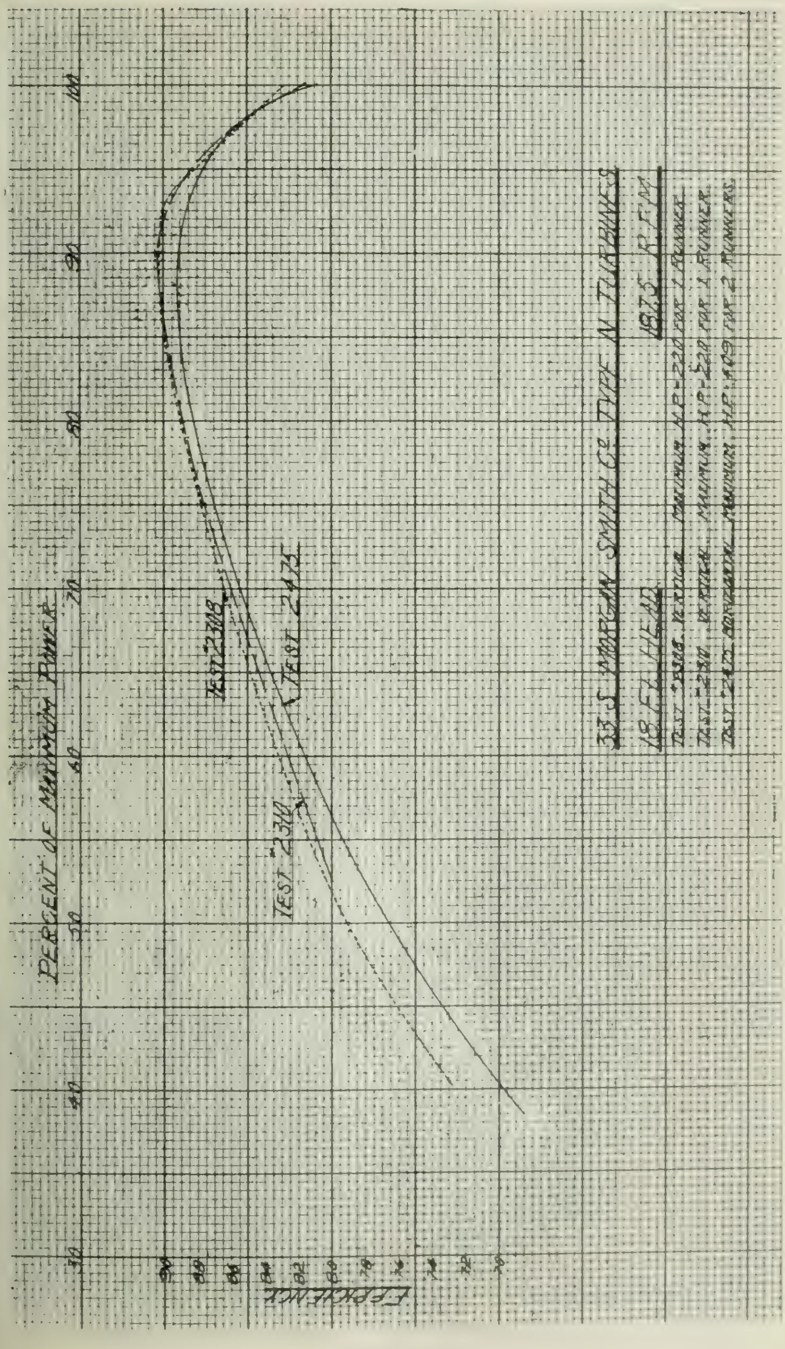
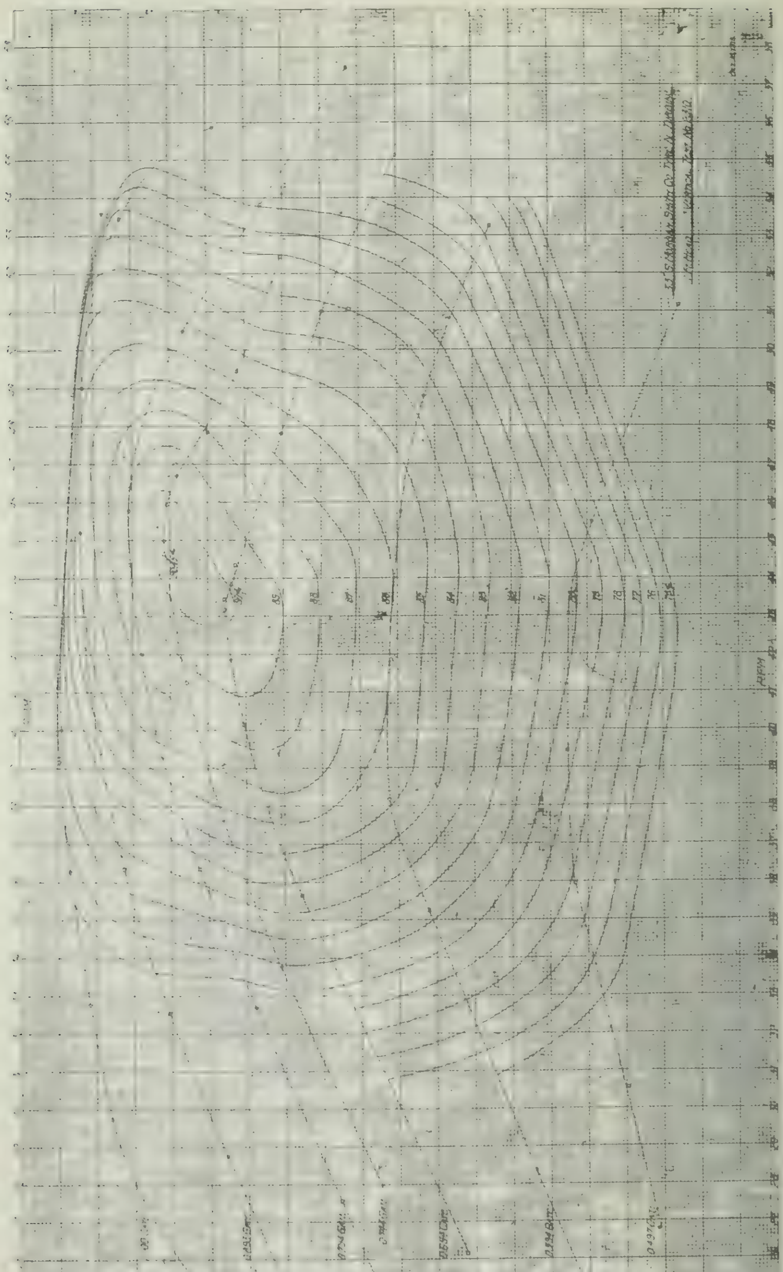

PERCENT OF MAXIMUM POWER
EFFICIENCY
TEST 2308
TEST 2475
TEST 2310
33 S MORGAN SMITH CO TYPE N TURBINES
18 FT. HEAD
187.5 R.P.M.

Fig. 1[illegible]



(Fig. 5)

TABLE NO. I

	Vertical Test No. 2310	Horizontal Test No. 2475
Best Speed R.P.M.	44.6	44.3
Maximum Speed 85% efficiency	51.3	50.7
Minimum " 85% "	36.7	36.1
Maximum " 80% "	54.8	53.3
Minimum " 80% "	33.2	32.4
Best efficiency	90.45%	89.17%
Horse Power at best efficiency—2 runners	5.23	4.72
Full gate horse power, best speed, 2 runners	5.75	5.36
Efficiency at 75% of full gate horse power.		
Best speed	87.4%	87.1%
Efficiency at 50% of full gate horse power.		
Best speed	78.2%	76.4%
Head at full gate	16.75 ft.	14.5 ft.

Respectfully submitted.

S. SVENNINGSON, *Chairman*.
ALEXANDER WILSON.
J. H. TRIMMINGHAM.

THE CHAIRMAN:—You have heard that very excellent paper. (*Applause.*) I would like to hear some discussion on that very valuable paper, and also recommendations of the different member companies who advised certain things to be done.

MR. WILLS MACLACHLAN:—In connection with the recommendation of the three companies with headquarters in Montreal, I think that this arrangement is in effect at the present time and with the reconstruction of the new constitution of the N.E.L.A. and the C.E.A., it will be made more general. Mr. Volkmann might correct me—I think that new constitution of

the N.E.L.A. is that the Chairman of the Committee on any subject in a Geographical Division is by virtue of that a member of the National Committee. In this way the work of the Geographical Division or of the Canadian Electrica Association will be made available to the National Committee and there brought into effect. But after working for the last few years on N.E.L.Aand on C. E. A. Committees, I think I can safely say that the local condition has to be looked after. Take, for instance, the N.E.L.A. Committee on Prime Movers, they are more naturally interested in steam development. We, in Canada, are more interested in hydraulic development, and thereforethe local committee is particularly needed to deal with the local situation.

THE SECRETARY:—I have read Mr. Svenningson's report before and noted the letters that he had from Messrs. Woodyatt, Julian C. Smith and one other. The proposition that the N.E.L.A. has put through at Pasadena was one essentially of decentralization rather than centralization. They want committees in each Geographic Division similar to the National Electric Light Association's committees. They appoint for instance, in a State Section a certain committee, the chairman of this committee is a member of the same committee in the Geographic Division. The Chairman of the Geographic Division Committee is a member of the same committee of the National organization.

From my conversation with Mr. Aylesworth, I know it is their wish to get the Geographic Divisions very active and have them work in harmony with the State and local committees.

MR. S. SVENNINGSON:—Do I understand that the Canadian Electrical Association—that is, the committee work of the Canadian Electrical Association—will be practically a Geographic section of the N.E.L.A.?

THE SECRETARY:—In the reorganization of the N.E.L.A., our association will be classed as a Geographic Division.

MR. SVENNINGSON:—So that we will have no separate committee?

THE SECRETARY:—Yes, we will have committees just the same as now. They are trying to get away from the big main committee in New York handling all details and they are trying to get it decentralized.

MR. SVENNINGSON:—Assume now that the smaller committee, Geographic Committee, carry out a certain amount of work and writes a report—

THE SECRETARY:—To that Geographic Division.

MR. SEVENNINGSON:—And that report again goes to?

THE SECRETARY:—The chairman of the Geographic Division being on the National Committee will deal with the problems on that committee which are of national importance.

MR. SVENNINGSON:—As it stands today, we have a small committee of three members trying to do the same work as the N.E.L.A. Committee of 30 members, and I do think by appointing four or five members from Canada on the American Committee, we would get a strong Hydro-Electric Committee on the American Committee, which consist mostly of steam men—and I think we would all get better results.

MR. MACLACHLAN:—Mr. Svenningson, could not that be left to the chairman or the representative on the N.E.L.A. Committee to deal with it?

Personally, I have presented to the members of the C.E.A. Committee a synopsis of the Minutes of N.E.L.A. Committees, and have kept them in close touch with everything that goes on in the N.E.L.A. Committees. We have been particularly careful not to duplicate but to take up those points that the N.E.L.A. committee are not taking up in detail, which are necessary to be taken up in detail in regard to local conditions.

THE SECRETARY:—Is not that the proposition, Mr. Onken?

MR. W. H. ONKEN, JR.—Yes. I think you will also have on the N.E.L.A. more and more engineers who are particularly interested in water power development because on the entire Pacific coast the question there is water power development—has nothing to do with steam, and the more water power developments they have out there the less use they have for steam power. Just now they have had a series of three years of drouth and they will have to produce the largest part of the energy produced on the coast from steam stations burning oil—just a temporary arrangement.

MR. SVENNINGSON:—As a matter of fact the N.E.L.A. has at least 8 or 10 hydraulic men on the Prime Movers Committee out of some 40 members. Compare this with our small committee of three members and you can readily understand that our committee work necessarily must be quite limited.

THE SECRETARY:—We can get more men on your committee if you want them.

MR. TURLEY:—I might say that Mr. Svenningson's idea would be worked out all right by the new treatment adopted by the National Electric Light Association if the chairmen of those divisions would attend the meetings of the N.E.L.A. That seems to overcome all the difficulty. But one of the difficulties that I think should be dealt with, and that is I think with the member companies—that is, "A" members of the Canadian Electrical Association should be impressed with the necessity of seeing that the representatives who are elected to attend these N.E.L.A. meetings do so and also see that provisions are made so that committees which are appointed here can hold their meetings. The reason that this comes up is that this year I attempted to hold a meeting of the Meter Committee of the Canadian Electrical Association, on two different occasions, and two members from different companies wrote me that their company objected to bearing the expenses of sending a representative to the meetings. I think the "A" members should have an interest in having their representatives attend these meetings, or probably they do not realize that there is any benefit to be derived from them. As a matter of fact I wrote to the manager of one of those companies and he replied that his man had been a representative for two years and he could not see any benefit to be derived from his being on the committee. This is an unfortunate circumstance, which I think exists in several "A" member companies. They do not seem to think there is any benefit to be derived from the C.E.A.

THE SECRETARY:—I do not dispute Mr. Turley's remarks in that particular, and I hope that with the revised consitution, if it is put through on Friday, that the various member companies will see quite differently the benefits which they will be able to derive from their membership in having their men attend meetings and sessions of the various committees of the N.E.L.A. and C.E.A.

MR. ONKEN:—I might mention that a number of members of the National Association found fault with the immense expense accounts incurred by their engineers in going out to different meetings, and one of the objects of the constitution of the N.E.L.A. was to avoid a whole bunch of committee work at national headquarters and have that committee work done more in Geographic sections, so as to cut down expense. One company, its expense account ran up something like $10,000, travelling expense, not counting the time of their engineers.

THE SECRETARY:—I think they are agreed they get some benefit out of it.

THE CHAIRMAN:—Any further discussion on this paper? We would like to hear something regarding the technical end of this paper — not so much representative of the N.E.L.A., but of more interest to the local members. Anything in connection with the technical end as regards our own requirements.

MR. TURLEY:—I would like to ask if anybody has any idea as to the expense of the system recommended and dealt with considerably by Mr. John Murphy with reference to the heating of the rack bars and heating of the wheels. I wonder if that has ever been tried out commercially and any figures as to the cost?

MR. SVENNINGSON:—The only waterwheel I know of in which the heating of the guide vanes was taken care of in the design of the unit has recently been installed by the Southern Canada Power Company in their Drummondville Plant. The scheme has, however, not as yet been tried out.

Mr. Murphy, I believe, has for some time applied a small amount of heat, by means of steam, to the cold metal parts of the turbine in order to prevent ice from blocking the wheels.

MR. GOULD:—Has Mr. Murphy succeeded in doing away with trouble in Ottawa?

MR. SVENNINGSON:—He claims he has.

MR. GOULD:—If he claims he has, that is evidence of some good. I am skeptical about it.

MR. MACLACHLAN:—I think it would be an easy matter to find out, if it was installed some 10 or 12 years ago.

MR. GOULD:—I was at a meeting at Chateau Laurier, Ottawa, just after opening of the hotel; we had a convention there when Mr. Murphy gave an illustrated lecture. Prof. Barnes of McGill University was there and I think I was impertinent enough at the time to tell them that their ideas and demonstrations sounded entirely all right in the month of June, but if I had them in a little place I know in the month of December, open water and blowing wind, I would be more assured what they had to say was practicable. I have never found out yet whether they really succeeded in doing away with the frazil trouble at Ottawa. It seems to me that I have seen in the newspapers that the service at Ottawa was more or less interrupted by ice.

THE CHAIRMAN:—I understand we have some three members from Ottawa here. They might be able to furnish us with information on that question.

MR. H. I. ANSCOMBE:—Mr. Dion could tell you more about that but he won't be down until tomorrow morning. If any of you gentlemen would

make a point of seeing him tomorrow morning. I am sure he would tell you all that is to be said.

As regards interruptions from ice up in Ottawa, well they have had trouble during the last winter, but as to whether Mr. Murphy's scheme is being applied at the Ottawa & Hull Power & Manufacturing Company or not, I don't know. I think it is not with the Ottawa Electric Company. If you could hold it over until tomorrow morning to see Mr. Dion.

Mr. Monro Grier takes the Chair.

THE PRESIDENT:—Speaking for the Chair, tomorrow I shall have the opportunity of asking Mr. Dion to see what he has to say.

MR. SVENNINGSON:—I might say that Mr. Dion was present here last Winter at the Canadian Institute when Mr. Murphy read his paper and showed moving pictures and apparently, as near as I could find out, Mr. Dion was very much in favor of the scheme.

MR. DODDRIDGE:—As Mr. Gould has just said, it is one thing to bring up a thing and demonstrate it and another thing to put it in actual practice, and surely if they had such a scheme fitted up in Ottawa, especially when the service was interrupted, it does not seem very practical, or something. However, Mr. Dion will be here tomorrow and any member that is interested in it, our chairman has assured us that he will bring the matter before Mr. Dion and if there is any information for the benefit of the members present he will be only to pleased to give the necessary information.

MR. WOODYATT:—I may say, Mr. Chairman, that our wheels are of that type; the speed rings are hollow so that we can inject steam or hot water and there is connection between the speed ring and the gates so that the heat can be extended up to them. But our plant only went into operation about a year ago and we were not in shape to try this out during last winter. As a matter of fact, last winter we had no ice trouble of any kind and there was no necessity for it. This year we will be in shape if we need it.

MR. GOULD:—Do you heat the racks at the forebay?

MR. WOODYATT:—No provision for heating racks but the racks are enclosed, the whole gate house is enclosed with very large windows facing the south so that the whole gate house, including racks is at very good temperature.

MR. GOULD:—The whole thing is housed in.

MR. WOODYATT:—Yes, but we do not know just how that will work, because last winter was an exceedingly favourable winter, and we did not have any ice trouble at all.

MR. SVENNINGSON:—It is a simple matter to pull up the racks while the frazil ice is flowing.

MR. WOODYATT:—I would like to say in connection with that, that sometimes data submitted to this meeting might be taken as practice to follow and I do not believe that Prime Movers Committee would recommend the practice of pulling racks. I think in Cedars case the wheels have extremely large openings and they can handle a pretty big piece of ice without difficulty.

THE SECRETARY:—I might state that the practice I think of all companies on the Canadian side at Niagara Falls is to pull the racks, during the winter

MR. SVENNINGSON:—We do practically the same on the Shawinigan system.

THE PRESIDENT:—Any further discussion on that paper? Mr. Svenningson will be only too pleased to answer any questions in connection with his very valuable paper.

As this discussion is evidently over, we will now adjourn for luncheon and meet at 2 o'clock sharp.

AFTERNOON SESSION

JUNE 16, 1920.

THE PRESIDENT:—We will continue the programme of this morning from the point at which we broke off, and the next item on the programme is the report of the Committee on Electrical Apparatus, by Mr. Neild. I regret to say that Mr. Neild has been prevented by the exigencies of business from coming here to-day, but I am glad to say that Mr. Wurtele is here and will read the paper put down for Mr. Neild. I therefore call upon Mr. Wurtele to read this report.

REPORT OF THE ELECTRICAL APPARATUS COMMITTEE

Mr. President and Fellow-members:—

Your committee on Electrical Apparatus, in reviewing the progress of the past year, find generally that power plants are suffering more or less from the results of war-time economy, and in some cases have experienced considerable trouble due to having put off reconstruction and are now faced with the necessity of renewing and expanding at very high cost. The executives of companies should bear this in mind where estimates are placed before them and engineers, generally, should see to it that a greater attempt should be made to use standardized apparatus, this being one way in which the increasing cost of extensions and improvements can be met and it is with this in view that your committee desire to bring before you the question of working toward single standard service voltages.

The different standards of service voltages require the manufacturers to design and make up comparatively heavy stocks of various devices to meet the varying demands of different localities, your committee would be glad to have a general discussion on this point so that there will be some guidance for future work along this line as we feel that a great deal of economy has already been effected by the use of standardized apparatus, it is our duty to urge the further extension of the principle where ever we can.

One question that recently has created considerable discussion is the method of excitation in large generating stations. The general trend is undoubtedly towards an individual source of excitation for each unit. The arrangement of using a common excitation bus is open to the objection that a disturbance or a break down, particularly the break down of a field, will spread to other machines causing in some cases considerable damage.

It has become standard practice in cases in large steam-driven generating stations to use generators with exciters mounted directly on the shaft end, operating experience has been very satisfactory, there being practically no electrical and very little mechanical troubles reported.

In some cases individual excitation is obtained by having a turbine or motor-driven exciter for each generator, this while satisfactory is probably much more expensive, and not so reliable or efficient. In the case of low head hydro-electric plants, however, it is often impractical to use shaft end exciters because of the large size and cost of the slow speed unit. In any case where individual exciters are used it is necessary to have a reserve capacity sufficient to provide excitation for the largest unit. This may be a motor or turbo driven machine or battery; probably a motor driven is the most economical installation.

Until recently it has been the common practice to operate control system from the excitation busses but in many larger plants these are being separated with the following results:—

The control system is not rendered inoperative by trouble on the excitation system. Grounds on either do not affect the other, and burn out pilot lamps by high voltages momentarily impressed by disturbances on the excitation system and consequent serious confusion in operation at time of trouble is prevented.

The grounding of the neutral of three phase systems is rapidly becoming standard practice for both 25 cycles and 60 cycles, particularly, has it been found to reduce generator troubles. The principal reason for grounding is to prevent abnormal voltage strains during transient disturbances. Your committee would suggest as a fruitful field for discussion, whether it is better to make the ground solid or through resistance, there being advantages in each way. At the station it is the usual practice to only ground the neutral of one generator at a time in order to avoid possible cross-currents between generators, however, these points should be brought out in the discussion.

The question of the automatic substation is rapidly forcing itself to notice and engineers and executives will do well to investigate their possibility very thoroughly and in many cases there will probably be an answer to the question of seeking an alternative to heavy outlays in feeder copper. While it is unlikely that the automatic substation will entirely supplant the attended substation, yet in all cases of extensions or additions careful thought should be given to the idea of installing automatic apparatus or semi-automatic apparatus on existing equipment, when attendants are employed.

The contributing factors to the desirability of the application of automatic substations are principally the great increase in operating costs due to higher wages and shorter hours, the increasing values of real estate, and excessive taxes in large urban districts and some operating engineers believe that service can be restored more rapidly after an interruption.

A review of the general practice of substation location will soon bring forcibly to one's mind the fact that the question resolves itself into one of a few large centralized substations with heavy equipment carrying a huge investment of feeder copper and a full staff of operators handling three shifts.

versus a greater number of smaller substations having automatic equipment of relatively small units in the centers of load areas, much smaller investment in copper, with fewer attendants but such operators are more highly skilled and better paid men.

In the field of purely A. C. substations have been in use for years very successfully maintaining the proper voltage on distribution feeders and the natural extension is to the reclosing of circuit breakers on feeders by the application of proper service restoring relays. One feature to be emphasised in selecting the proper oil switch, is ruggedness, to ensure sufficient capacity in cleaning the trouble. Attention must also be given to the proper selection of relays for the service so arranged to open the feeder only in case of trouble within the feeder itself and not to open for trouble beyond the feeder. The development of the relay has had a very great deal to do with the extension of the automatic station and study of this apparatus will well repay any company engineer. Members are advised to read the report of the history and development of the automatic contained in the report of the committee on power generation, American Electric Railway Engineer Association, October 1919 Convention.

In the field of the outdoor type substation general progress is noted and in substations supplying distribution from 2300 to 7500 volts it is possible to install not only an entirely automatic equipment but outdoor type or semi-outdoor type as well.

Transformers for outdoor service up to a capacity of 12000 K.V.A. three phase core type 60 cycle self-cooled can be obtained. We understand orders are placed for two of this size as step up transformers 4500/27,600 volts. All the 4500 volts apparatus is to go in the generating station but the 27,600 apparatus is all for outdoor service.

Report is also made of the purchase of two transformers 10,000 K.V.A. 27,600/110,000 volts three phase self-cooled with complete switching equipment for outdoor service.

In the field of transformers generally the question of standardization is being dealt with by the Transformer Sub-Committee of the Canadian Engineering Standards Association, but as this Committee is dealing with distribution transformers only, we would suggest that a discussion take place and an expression of opinion be forwarded to that sub-committee as to whether the standardization of power transformers should, in the opinion of the Canadian Electrical Association, be proceeded with.

One question brought up before the transformer sub-committee of the N.E.L.A. was the relative fire hazard of air blast and oil-immersed transformers. This sub-committee broadened the scope of their investigation to include the degree of immunity from fire hazard of all oil-immersed apparatus and owing to the importance of the question we quote the report in full.

In considering the hazard of oil-immersed and of air blast transformers, the number of units of each type involved must not be overlooked, or false conclusions will be drawn. In sizes about 200 K.V.A. there are probably at least one hundred oil insulated transformers installed to each air blast.

In the installation of air blast transformers, generally one or more banks, that is, units of three single-phase or one three-phase transformer, are installed, ventilated by a single blower, so that in case of fire in any unit either the blower must be shut down and the other units jeopardized, if their operation is continued, or the blower continues to operate and the defective transformer burns itself out, unless extinguished by some special means. Probably not more than a dozen fires have occurred on air blast transformers, and all of these on older types, and seldom has the fire communicated to other apparatus.

Transformer construction of the oil-immersed type, as furnished by the various manufacturers in the earlier years, was not always as immune against spread of fire originating within the transformer as are present day designs. The principal improvements to eliminate the possibility of explosions and fires have been the removal from above the oil surface of unshielded conductors with their corona hazard, and the discontinued use below the oil level in tank construction of solder or other materials of low melting point.

In case a transformer proves defective and an external short circuit results, it is the opinion of the sub-committee that fire is now a very remote possibility. Oil will not support combustion until its temperature has been raised to the vaporizing point, which is relatively high, and even in this case, not unless oxygen is present. In case fire should start, experience indicates that it would be localized to the transformers.

While fires have been known to occur in oil insulated transformers, any assumption that the use of oil in modern transformers creates the hazard is not correct, since explosions have occurred inside of such transformers with no further damage than the breaking of the cover or the distortion of the tank.

The liability of explosions in good present-day construction is further lessened by the fact that the atmosphere above the oil is maintained at ground potential and free from any static stress.

This is accomplished by having the metal supporting the leads or bushing extend down below the oil level so that any other voltage creating possible discharge must occur under the oil and consequently be smothered instead of, as in the past, occurring in the gaseous atmosphere above the oil.

Further precautionary steps have been taken recently by at least one large manufacturer in the development of tank construction in which the tank is completely filled with oil. A small auxiliary tank is provided above the main tank to which it is connected. The oil extends up into this smaller tank and thereby prevents the effect of varying level due to temperature changes from reaching the transformer.

In large units, such as are usually used in indoor installations the oil insulated transformers are commonly water-cooled, the oil then operating at a lower temperature than the oil in self-cooled units. Such water-cooled units are obviously less likely to be damaged by fire from the outside. In present day practice, large self-cooled units are generally installed out of doors where communicating damage from an external source is very remote.

Several years ago one of the large manufacturers of transformers made some experiments to determine what was necessary to set a tank of oil on fire, and after it was on fire, how difficult it would be to put the fire out. For

this purpose about two hundred gallons of oil were placed in a tank which had welded corrugated sheet iron sides, cast solidly into cast iron top and bottom. The fire was placed under and around the tank, but the oil could not be ignited until burning waste had been thrown into the tank. When the oil was burning the flame was extinguished without much trouble by the use of Pyrene extinguisher. The oil was finally allowed to burn itself out and the tank was found to be still intact and oil tight. The oil did not boil over but simply burned up from the fire on the surface. The manufacturers state that it is their belief that with a tank of this type or with a boiler iron tank, if the oil becomes ignited it will in all probability be confined to the tank and will not boil over or spread oil in the space adjacent thereto.

It seems established, therefore, that no unusual fire hazard attends the use of oil-filled electrical equipment.

The interruption capacity of oil circuit breakers is at the present time, an uncertain quantity, due largely to the fact that the manufacturing companies have not sufficient generating capacity to furnish the extremely large currents necessary to test the circuit breakers. Those operating companies which have a sufficiently large concentration of power to make such tests, are reluctant to do so because of the possible damage to their apparatus and consequent impairment of service to the consumers whom it is their duty to serve.

Heavy short circuits and extraordinary conditions of various kinds do accidentally occur, however, and it is desired to render available to the three organizations above, and to the manufacturers, data as to the performances, unsuccessful or successful, of oil circuit breakers under extraordinary conditions. Such data, carefully given and analyzed, will enable the values of interrupting capacity under various conditions to be more accurately determined, and will greatly assist in improving oil circuit breaker designs.

We are bringing before the meeting the following request for data which we believe should be discussed and if found advisable, should be followed up by the chairman of the Electrical Apparatus Committee for the ensuing year.

REQUEST FOR OIL CIRCUIT BREAKER DATA

(*a*) What is your practice with regard to the number of times an oil circuit breaker is closed after it has opened automatically under short circuit conditions, and what intervals of time between openings do you allow? If different for different voltages or classes of service, please state for each.

(*b*) What would you consider satisfactory operation of an oil circuit breaker? For instance, would you consider that a breaker should be capable of performing a certain duty cycle and then be in condition to be closed for non-automatic operation, or, if not, what would you consider satisfactory operation?

(*c*) Would you prefer to have an oil circuit breaker rated at its ultimate interrupting capacity, or at some percentage of that value? If the latter, would you consider 50% reasonable, which corresponds to a factor of safety of two?

(*d*) What is your practice as to the frequency of oil circuit breaker inspections, and do you make them?

(*e*) Have you had any fires on oil circuit break rs or caused by oil circuit breakers in operation or placed in operation during the last two years? If so, please describe fully, giving the type and size of breaker, and the year purchased.

(*f*) Have you observed after heavy short circuits which have occurred during the last two years, any evidence that the contacts of the oil circuit breakers have been forced apart due to the mechanical strains set up by magnetic fields, or that the breaker showed any signs of distress due to the thermal effects of heavy circuits? If so, please describe the circuit breaker fully, giving type, size and year purchased, describing also the effects observed.

(*g*) Have you experienced any trouble during the past two years on oil circuit breakers due to heating under normal operating conditions? If so, please describe the breaker and the trouble.

(*h*) Is your practice to use a factor of safety in selecting an oil circuit breaker to provide against a decrease of current carrying capacity with age? If so, what factor do you use?

(*i*) Have you experienced any trouble due to potential stress produced under normal operation or during surges, or any trouble from static sparks? If so, please describe breaker and experience.

(*j*) Have you any evidence as to the effect of low power factor on the interrupting capacity of oil circuit breakers? If so, please describe.

(*k*) Describe any recent tests you may have made on oil circuit breakers in connection with interrupting capacity, their object, the kind of equipment used for the test, and give any suggestions as to methods or equipment which might be used to advantage on future tests.

(*l*) Have you changed the speed of mechanical operation of any of your oil circuit breakers, giving a faster parting of contacts? If so, with what results?

(*m*) Have you had any experience which throws light upon the question as to whether it is better to confine the gases in an oil circuit breaker tank upon opening under short circuit, or whether it is better to vent the gases to the atmosphere under such conditions?

(*n*) There is at present, no standardization of oil by the different manufacturers of oil circuit breakers. Do you use oil of one manufacturer in the breaker of another, and with what results?

(*o*) What is your practice regarding periodically filtering or changing the oil in circuit breakers?

(*p*) What has been your experience with regard to the operation of outdoor oil circuit breakers in cold climates? Please describe the breakers in question, the range of temperature under which they operate, the kind of oil used, the effect of low temperature on the oil and on the operation of the breaker.

(g) Have you had any trouble from condensation of moisture in switch compartments? If so, please describe and tell what methods were adopted to remedy the trouble and with what success?

REPORT ON OIL CIRCUIT BREAKER PERFORMANCE

1. Name of operating company.
2. Location main office of operating company.
3. Date of performance.
4. Was breaker installed indoors or outdoors?
5. General weather conditions and temperature.
6. Complete rating of oil circuit breaker involved, including serial number and how installed.
7. Describe any modifications in the circuit breaker which may have been made prior to performance.
8. Condition of circuit breaker, kind, height and condition of oil in circuit breaker on last previous inspection made on..................date.
9. Operating voltage and frequency.
10. What was manufacturer's interrupting capacity rating, on what duty cycle, and with what factor of safety?
11. How many times did breaker open the short circuit, and with what time intervals between?
12. Give your best estimate of the root mean square current, symmetrical value, which the breaker interrupted at each opening, or give data from which it could be calculated. This data should include: a one line diagram of connections showing the relation of the fault to the apparatus supplying and transmitting energy to it.

The K.V.A. rating of each generator in service at the time, and the reactance of each generator.

The K.V.A. ratings and reactances of any reactors or transformers which would influence the amount of current passing through the breaker.

The connected K.V.A. capacity of other synchronous apparatus connected to the system at the time, such as rotary converters or synchronous condensers.

A description of any cables or lines which might affect the amount of current which could flow.

Make type and setting of relays, and make, type and ratio of current transformers associated with them, together with any other data which may give an idea of the number of cycles over which the short circuit was maintained.

13. What was the nature and location of the fault causing the breaker to open, and statement of any unusual occurrences noticed before the breaker opened.
14. Detailed description of all damage to, and all marks on breakers or surrounding apparatus, insofar as relating to the breakers performance. Include photographs if possible, and in addition give information on (a) amount of smoke, (b) amount of flame and location, (c) amount of oil thrown, (d) permanent deformation of oil vessel or structure, (e) burning of contacts.

(*f*) evidence of mechanical or thermal stresses due to heavy current. (*g*) special observations, including arcing to case, to ground or to adjacent apparatus.

15. Are circuit breakers periodically inspected? If so, how often and what method do you use?

There is one field of development which in the past has been more or less neglected and that is the telephone.

The research work done can be well summed up by quoting President Thayer of the American Telephone & Telegraph Company as follows:

Great progress has also been made in subscribers station and central office apparatus. Improvements, making both for economy and efficiency, have been perfected and standardized for use.

Among these the most important is the machine switching system which has been the subject of constant study and experimentation by this department over a period of more than ten years.

It has been necessary not only to produce apparatus which would operate efficiently and economically, but also to perfect all of the details necessary to make this entirely new apparatus function properly in relation to the existing apparatus, the present buildings, the practice of the public, etc. That is, after its completion as an efficient mechanism it was necessary to make all of the adaptations so that its introduction would be economical and without disturbances to the public. This has been accomplished.

During the past year the Engineering Department has been engaged in planning and directing the introduction of machine switching or automatic switchboards into the Bell System. It is our plan to study each improvement in apparatus to determine how it can most economically be made a part of the plant. Such studies show that in the large cities machine switching equipment should be employed for extensions necessary to provide for growth and for reconstruction to replace wornout equipment. Our experience has shown that by this procedure we are enabled constantly to change to new types of apparatus as they are developed, with the least amount or disturbance to the service, in the minimum time and without disturbing effects upon the employees or on the financial situation. Thus loss and waste incident to sudden change are avoided, apparatus not sufficiently proven in is not incorporated into the plant, and the entire physical property of the system is by easy evolution keeping abreast of the development of the art of telephony.

By the use of these automatic switchboards as we have planned to introduce them, increased capacity will be provided with proportionately small increases in the number of operators required, with a simplification of the service conditions in the large cities. While these automatic switchboards are more expensive in first cost than the manual switchboards, it is expected that the decreased operating expense of the automatic will do much to offset the increasing cost of giving telephone service.

From the invention of the telephone, the Bell System has continuously developed the telephone art of which switchboards are but a part. New improvements in telephones, switchboards, lines and cables have followed one another with remarkable rapidity. While each successive type of apparatus

to the superficial observer sometimes suggested similarity, nevertheless, each step in the evolution marked a decided improvement.

In general, these impr vements have been of such a nature that they have not necessitated a change in the methods used by subscribers in making calls. One of the factors of the machine switching problem which added to its complexity was that from its ve y nature this system necessitated a change in the manner in which a subscriber made his telephone calls. This phase of the problem had to be most carefully considered so that the arrangements adopted for all classes of calls would be simple and could be employed by all subscribers without the chance of complications, difficulties or misunderstandings.

From the time of the earliest switchboards there has been a constant effort to perform various operations automatically so far as consistent with the service requirements, and many new features have been introduced from time to time for reducing the work required on the part of the operator. In line with these developments, telephone engineers early applied themselves to the problem of completing calls entirely without the aid of an operator. Many forms of automatic systems have been developed and tried out from time to time, but none of these satisfactorily fulfilled the complicated service requirements of large cities.

An indication of the magnitude of this problem may be secured when we consider that in New York City, for example, there are at present a total of nearly one million telephone stations served from about ninety central offices, and the predictions are that within the next twenty years the stations and central offices will have more than doubled. Each subscriber in this great network must be able to reach promptly every other subscriber. Due to large area involved a great number of calls within the city necessitate extra charges, which means that they must be specially supervised and ticketed. There are many different classes of service furnished the public, such as measured rate, flat rate, official coin box pay station, attended pay station, and other special services such as information, etc. Not only individual lines but party lines and private branch exchanges must be cared for. Furthermore, demands for service to the extensive suburban area surrounding this great city, as well as to the vast number of cities, towns and rural communities throughout the entire country, require that provision be made for thousands of toll messages daily which must be recorded, supervised and timed. It will be clear that the problem of producing machine switching equipment which will satisfactorily perform a sufficient amount of the labour involved in handling the above service, so as to replace enough operators to warrant its existence, is not one that could be solved except after years of development work. It will also be evident that systems which might operate satisfactorily in cities of small or medium size, where service requirements are comparatively simple, would not meet conditions in these large metropolitan areas.

As a result of exhaustive investigations and long continued experiments, the engineers of the Bell System have produced an automatic switchboard which satisfactorily meets even the exacting service conditions just referred to. It may be interesting to note in this connection, that as a final step in the

development of the system, three complete central office equipments of the machine switching type were installed at Newark, N. J. These installations were made on what is known as a "semi-mechanical" basis, that is to say, operators were employed to take the calls from the subscribers and transmit them to the machinery by means of numerical keys. It was thus possible to try out this form of apparatus without introducing any new method of calling on the part of the subscriber during the trial installation.

The results of these trial installations demonstrated conclusively that the new machine switching system would meet all the essential service requirements of our largest cities. The work of manufacturing equipment of this character is already well advanced andt he first installations will be placed in service early in 1921.

Respectfully submitted,

W. H. McINTYRE.
C. J. PORTER.
M. D. SCHWEGLER.
J. S. H. WURTELE.
J. F. NEILD, *Chairman.*

THE PRESIDENT:—Doubtless Mr. Wurtele moves the adoption of that very interesting report. Will some gentleman kindly second it so that it may be open for discussion?

MR. McDUNNOUGH:—I will second it.

THE PRESIDENT:—It is now open for discussion and I hope all those who have any points to raise in connection with the matter will do so.

THE SECRETARY:—One point brought up in connection with the paper is the use of individual exciters. I might state that the experience of our company is satisfactory with using exciters of that type.

MR. MACLACHLAN:—In connection with fighting oil fires, Foamite, which was developed for fighting oil fires in very large oil tanks in New Mexico, has been put on the market in smaller sizes and is used quite satisfactorily in fighting transformer fires. At the same time experiments are

being carried on in trying to get a Fomite that is not a conductor, so that it can be used around live apparatus. The Fomite that is on the market now is a conductor and is not safe to use around live apparatus.

MR. TURLEY:—In connection with that, if pyrene is put on——

MR. MACLACHLAN:—It will affect your oil to a certain extent but carbon tetrachloride extinguishers will not be efficient in putting out oil fire because it will go right into your flame, whereas Formite will float on top and smother your blaze. Carbon tetrachloride extinguishers on straight oil fires will not work as efficiently as Fomite will; Fomite being designed particularly for oil fires and will smother.

THE PRESIDENT:—Gentlemen, we have already with us Mr. Lincoln who will give us a paper tomorrow, and I should like to say before his face, as I have already said behind his back, that we welcome him here very heartily indeed and anything he can give us in regard to this particular matter under discussion which, of course is something very well known to him.

MR. P. M. LINCOLN:—Mr. President and friends of the Canadian Electrical Association, I am only too glad to stand here before you because I know I have many friends among the members of this society.

There was one point which was metioned in the report which I want to lay a little stress upon if I may, and that is, the grounding of the neutrals and the advantages of that method of operating our plants in order to keep them free from the difficulties which arise from defects. I have always been an advocate of that method of operating plants and I have always been an advocate of grounding the neutrals so as to avoid difficulties that arise due to a casual ground. There is one case that I have in mind particularly and that is a case where many years ago I was called in to consultation. Some of you may be familiar with it. The Hamilton Cataract Company at their plant at Decew Falls, some years ago—I think it was about 1903 or 1904—had a very serious difficulty owing to the fact that a casual ground would develop occasionally and that casual ground would cause exceedingly high potentialities and I think, if I remember correctly, all of the generators went out and the town of Hamilton suffered from the removal of practically all of the power that they had available. I was called in to consultation at that time and advised Mr. Hawkins, who was then the General Manager, to ground the neutrals of his generators and leave them grounded. Now, that difficulty occurred at least 16 years ago, possibly 17 years ago. I called on Mr. Hawkins in Hamilton the day before yesterday and asked him whether he had any repetition of the trouble that I was called in on consultation at that time and he assured me that he had not had any repetition of that trouble whatsoever. In other words, that he had passed through those 17 years with those neutrals grounded and without any tendencies, so far as he could observe, towards a repetition of the trouble which was so serious before that time. There is one instance in which the grounded neutral did work out very well.

Another instance which I know about personally is the experience of the Montana Power Company, Montana. They have a very extended system, a system of 110,000 volts transmission, and I presume the system must have at the present time something like a thousand miles of transmission line. Up till about five years ago that system was operated without any

ground on the system. There was no grounded neutral whatever. The system at that time began to show signs of very serious trouble. They would get a casual ground at one point in the system and they would get blown up apparatus circuit breakers, transformers or generators at another point, it might be a hundred or two hundred miles away, and an analysis convinced them that there was a great possibility of the trouble being due to the absence of the grounded neutral. They adopted a grounded neutral on 110,000 volt transmission line and put that in thoroughly about five years ago. Since that time they have had practically no repetition of the trouble which before that time had been very frequent, and the engineers of that system are completely converted to the method of operating transmission line, or distributing system with thoroughly grounded neutral.

The question has been raised as to whether that ground shall be made dead or shall be made through resistance. That question I think should be answered on the basis of whether or not thorough protection to the apparatus itself can be secured when the neutral is dead ground. If the neutral is dead grounded and another casual ground occurs, there is complete short circuit and the current which flows under those conditions may be very large, large enough so that the repulsive effects within the machine, transformer or generator as the case may be, may wreck the machine. The only reason for using resistence is to reduce the amount of current that can flow under those conditions. Modern generators and transformers are usually made strong enough so that they can stand short circuits without these resistances.

However, there are some transformers and generators—some of the older generators, made before the problem was recognized—which are not able to stand dead short circuits; that is, the stresses set up are so great that the windings are apt to be wrecked. In those cases it is essential that the grounding be done through a resistance. However, with modern design of machines I do not believe that it is essential that resistance be used. I think that is all the comment I have to make.

THE PRESIDENT:—I am sure we are all extremely indebted to Mr. Lincoln for his kind and useful contribution to this subject.

MR. DODDRIDGE:—In regard to grounding of neutrals, especially on secondary systems, about eight years ago we had a very serious fire, burned down four properties, and insurance companies through one of the individuals took an action against the company. They won in the first court and we appealed it and we won in the second. They won in the third and we appealed to Privy Council. Judgment was given a short time ago, (of which I have a copy with me), and cost our company about $65,000 to $70,000. Since that judgment was given we have had three actions taken within a month now for fires. Of course in the first case we had not the secondaries grounded and they claimed that we had not taken the necessary precaution. At that time we proved by the most expert men in the country that it was not the usual practice. While in some cases it was to the advantage of having secondary grounded in the case of high tension current, but in the case of grounded secondary it was an added reason for fires and there have certainly been a number of fires through grounds. As I say, within the last few months we have three actions to contend with, claims amounting to $7,000. The last case on the first of this month, the parties in the house had a card party

that evening and they did not know until the firemen broke in on them. The firemen said that every nail that had punctured the tin was simply setting off fireworks.

Consequently, if this is allowed, certainly the insurance companies will not pay any risks for fires. In cases of severe storms it is a case of whether advisable to shut down or not. The companies cannot stand the risk.

Unfortunately, in Quebec, all outlets are from the attics and consequently no other means of getting to it but fastening to the roof. So that it is a serious proposition. I understand in Montreal now they are prohibiting the putting of outlets on the roof; they have to bring them around the building. It is a serious proposition now for the lighting companies that they have this to contend with.

THE PRESIDENT:—Mr. Woodyatt, have you anything to say on this particular point just raised, or any other gentleman from Montreal?

MR. L. A. KENYON:—I might say that our company have had no particular trouble with fires from wires grounding on roofs. We have had occasions where fires were caused by wires on roofs, tin roofs becoming alive from the grounded wires. This, of course, would be obviated if the tin roo s themselves were thoroughly grounded and current was carried away through proper ground connections. There are a number of cases where such fires have happened; some have been caught before the trouble was very serious and the wires later removed. We have many cases where wires come in contact with roofs due to workmen moving wires to carry on building operations.

As far as taking action against power companies, I do not think our company has had any actions instituted to date, but if it is liable to have such actions taken, we would like to go into this question thoroughly so as to get the building bylaw changed so that it would be compulsory to have all tin roofs grounded.

MR. DODDRIDGE:—I might state, in discussing it with our lawyer yesterday afternoon he advised that some body or association such as Canadian Electrical Association should take some action to have a law enacted such as railways have—for instance, fires from smoke stacks that almost unmentioned damage could occur, they have the amount limited to $5,000, in that case that no fire to exceed the sum of $5,000 in any one instance, that is providing they can prove that the smoke stack in use and everything else was the best that modern means could provide, or there was nothing better. It being no fault on their part that this occurred, as it was absolutely necessary that this smoke and certain amount of sparks get out. They have an Act, (and he read it to me) in no case shall the amount exceed $5,000. If something was brought before our legislature, by this association along these lines as to their responsibilities, all companies would be kind of protected.

THE PRESIDENT:—What occurred to me is this: That the Executive for the next year might very well take up this subject amongst its activities and see if something cannot be done in the way you suggest, unless you want to suggest something more definite.

MR. DODDRIDGE:—No.

THE PRESIDENT:—Any other gentleman wishes to speak on this?

MR. GOULD:—Mr. President, in connection with the subject, I cannot elucidate the thing any, but I have a little anecdote to relate. In our plant,

only a small plant, we had a machine of 750 k.w. in operation. We installed another one of the same capacity, and on the switchboard we had two oil switches, and when we attempted to synchronize these machines they were short-circuited and would not go together. It was not an automatic switch, it was a hand switch, the automatic switch being on the other one. It caused a short circuit. Well, we tried it again with the same result and the operator pulled the switch again. The old installation was running and supplying current to the line; the new installation was in operation with the switch pulled out. There occurred an explosion which nearly blinded our superintendent. We never could understand the reason why that thing exploded. We found out afterwards that the new installation was out of rotation with the other one; it should be running the other way. We changed that afterwards when we found out what the trouble was and we got the two machines synchronized all right, but the question was, and is yet, what caused that switch to explode. It did not explode at the time but some minutes after the second short circuit. I have interrogated various electrical engineers since I am not very much of a technical man myself and I have been informed that there were gases formed in that switch by the short circuit which afterwards exploded, but why they should explode afterwards and not at the real time of the short circuit is something that I have not yet had explained. It broke a three-phase switch made by the Monarch Company of St. Lambert. It destroyed six insulators in the switch. We replaced these and the switch is apparently as good as ever. I do not know whether anybody else has had such experience before or not.

The President:—I have no theory to offer on that. I suppose I am the only one in the room who has no theory, but if anybody has something authoritative, I am quite sure Mr. Gould would be glad to listen to it. Any other gentleman who wishes to take part in the discussion?

Mr. Turley:—With reference to the particular explosion he refers to, we had a couple of incidents that seem to rate up pretty closely with that. These occurred in 400 K.V.A. transformers. There were two of them. The transformers became short-circuited and burned out and a pressure developed inside of the transformer case. They were designed for outside service and were made absolutely air-tight as well as pressure-tight, and when this short circuit took place in the transformer it apparently generated a gas on the top of the oil, which expanded the transformer until such time as they broke away and allowed this pressure to leak out. I would imagine the same thing happened in that switch. This short circuit had occurred there, and if you let heat to the oil it will not generate the gas instantaneously. The heat is there; it should generate gas fairly slowly, after a while it will generate enough to blow the top off. I know that is what we found in these transformers.

The President:—That seems to agree with Mr. Gould's notion. Well, gentlemen, if there is no further discussion upon the point I will put to the meeting the adoption of this report. Moved and seconded that this Report on Electrical Apparatus be approved. (*Carried*).

The next item upon the programme is Report of Committee on Overhead Lines by Mr. R. J. Beaumont. I have the pleasure to tell you that I understand that he also has something else ready to give to us in addition to this report, and I will now have the pleasure of calling on Mr. Beaumont

REPORT OF THE OVERHEAD LINES COMMITTEE

Mr. President and Gentlemen:—

As chairman of this committee I regret to report that we cannot be accused of having been extremely active since our appointment some four or five months ago, and this has mainly been due to, I am afraid, pressure of other work.

Your committee have corresponded with various authorities dealing with such subjects as the National Electrical Safety Code and with various problems in connection with the subject naturally falling within the range of work of the committee. It might be interesting to state here that during the year the writer has been engaged in standardization work for the Shawinigan and associated companies, and as a result of the work done a handbook has been printed and issued amongst the engineers and operating men of the company covering the standardization of overhead construction in cities and towns, and also covering transformer standardization from the distribution type to practically the largest type.

The result of the work of standardization, particularly distribution systems, notably affected the quantity of material to be carried in stores. Of course, in using these figures it must be borne in mind we are dealing with a large system that originally consisted of smaller companies and municipalities. For instance, taking the case of one 4-pin cross arm. This cross arm was used and carried in the stores in about twelve different sizes. This size has now been brought down to one and the same story and economy has been brought about in the cases of bolts, cross arm braces, and other materials.

Another advantage in standardzation in such a system has been that it controls the question of the type of construction to be used for dealing with specific cases, and removes from the foremen and local superintendents the question of using discretion as to design so that the final design represents the combined ideas and experience of ali the men from the different parts of the system.

In the work of standardization it can hardly be said that any radical change was adopted, but this booklet in its more or less finished type today can be said to be very concise and might almost be considered in the way of a book edition of the N.E.L.A. handbook dealing with the same question and in its work of standardization, we have to acknowledge the assistance obtained from this handbook.

With regard to the question of standardization of the transformers, so far as our particular system is concerned we have decided to adopt 2300 volts as the standard distribution voltage, and at this point we might say we would like to hear the question of transformer standards discussed particularly with reference to the work that is now being done by the Government Committee of Standards.

We are interested, particularly, in the question of polarity of the distribution type of transformers and are strongly of belief that it should be subtractive instead of additive, but would recommend this for discussion before this Association.

There are also one or two other points up before the Association that might with advantage be discussed and they could well form a subject for part of the work for next year's committee..

With regard to the rubber glove specification authorized by the Association last year, we find the manufacturers in Canada very reluctant to fill the requirements of the specification in its entirety, and in fact today if we are to purchase in Canada I am afraid specification cannot be used; but in order to carry this matter forward we are in correspondence with the chairman of the Accident Prevention Committee, and with the help of the manufacturers expect that a satisfactory solution will be arrived at at an early date.

Respectfully submitted,

C. G. CHOATE
O. V. ANDERSON.
A. A. DION
A. P. DODDRIDGE.
L. A. KENYON.
R. J. BEAUMONT, *Chairman.*

MR. BEAUMONT:—That report is rather short, but perhaps there might be some discussion. I move the adoption of the report.

MR. DODDRIDGE:—I second the motion.

MR. MACLACHLAN:—On the matter of rubber gloves, I would be very glad to second that report so that it will be very throughly considered in future.

THE PRESIDENT:—Is there any discussion upon this report?

MR. MCDUNNOUGH:—As a member of the special committee on Transformers of the Engineering Standards Association I might say we have got out transformer specifications for distribution transformers up to 100 k.v.a. capacity and 13000 volts. This report is at present being compiled by the secretary and then has to go to the main body of the committee and will probably be released for publication in a month. At present we cannot say very much about the results.

THE PRESIDENT:—Any other discussion?

MR. A. V. GALE:—I would ask Mr. Beaumont if he could give us the dimensions of the 4-pin crossarm he has made standard for 2200 volt operation.

MR. BEAUMONT:—You mean just the width and depth? $3\frac{1}{4}'' \times 4\frac{1}{4}''$, but we will give you copy of the specifications, Mr. Gale.

MR. TURLEY:—Nothing in your specifications to cover cross arm pins.

MR. BEAUMONT:—Yes, we have covered pins and braces.

MR. TURLEY:—Have you any experience with birch pins as against locust pins?

MR. BEAUMONT:—No, we have no experience with birch but at the present time we expect to make a small experiment with elm.

MR. TURLEY:—We have been using birch pins for a long while and recently attempted to purchase locust pins and we find now that the standard of locust pins—that is the diameter which fits into the cross arm is supposed

to be $1\frac{1}{4}''$ and $1\frac{3}{4}''$. All we can procure is $1\frac{3}{4}''$ slack. Do you buy your own pins?

MR. BEAUMONT:—No, we manufacture our own pins.

MR. TURLEY:—I would like to hear from anyone who is using birch pins, why they are objectionable.

MR. GALE:—We have used birch pins for some time but we find that the birch gets dosey in a very short time and break off across the grain and consequently we have discarded the use of birch pins.

MR. C. THORNTON:—We had on our 50,000 volt transmission lines for 10 years an assortment of wood pins consisting of oak, elm, birch and maple. An examination of these woods after 10 years service, showed that elm appeared to be the best material for this class of work. The wood was still sound. Threads were not digested from the effects of the high voltage. The other materials were all badly digested on threads.

THE PRESIDENT:—Any other remarks? It has been moved and seconded that this report of Committee on Overhead Lines be adopted. (*Carried*).

MR. BEAUMONT:—These notes I am going to read at the present time perhaps might be intruding on the territory of the Power Sales Committee, but I will ask the Chairman of that committee to give me a little privilege in that direction. I have headed the notes "Power Prices Past and Present," and to my mind the subject is somewhat pertinent today.

POWER PRICES, PAST AND PRESENT

In a few words I will endeavour to compare briefly the conditions forming the basis of power prices a few years ago with the conditions found at the present day.

Popular opinion and also the opinion of the average electrical man is to the effect that the cost of generating power in existing plants has been little affected by the increased cost of materials and labour, though in the case of absolutely new power plants and lines it has been conceded that they cost more than heretofore, but, generally speaking the relation of the new cost to the power price has had but little thought.

The main items of cost which go to make up the total cost of any undertaking may be stated as being in the main three items, the cost of financing, the cost of materials and the cost of labour.

Let us first consider the cost of financing today as with a few years ago. It will be found that five or six years ago money could be obtained at an outside cost of 8% per annum. By outside cost it is meant the actual percentage to be paid in negotiation. Today this cost will be found to be practically 9% per annum. This figure may, on the first consideration, seem high, but as it includes all costs, the items of which have all considerably advanced, it is today a moderate figure.

Let us now consider this figure in conjunction with the increased cost of a complete new plant and we will arrive at the following conditions. We first, however, will have to make an assumption on the increased cost of the plant and equipment as compared with a few years ago, and for the minute we will take this value as having increased three times. This actual increase I will deal with in more detail a little further on, but using this figure of three

times it will be seen that the same unit of value as compared with five or six years ago, will today mean a yearly burden of 27% per annum as compared with 6% or expressed arithmetically the interest has increased one and a half times and the cost three times, or the total overhead burden four and a half times which gives us the figure of 27%.

Studying the increase in the cost of materials used in power stations, transmission lines, etc,. it will be found that a great increase has occurred, and below is given some of the more common materials.

	1914	1920	Increase Percentage
Copper wire	$ .15 per lb.	$ .28 per lb.	87%
Weatherproof wire	.16 " "	.33 " "	106
50,000 V insulators	1.50 " "	6.50 " "	335
25,000 V "	.50 " "	1.75 " "	250
2200 V glass insulators	35.00 per M.	91.00 per M.	160
Poles 30′ cedar	1.75 "	7.00 "	300
Poles 35′ cedar	2.00 "	8.00 "	300
50,000 V cross arms	.50 "	1.40 "	180
2200 V cross arms	.42 "	1.20 "	185
Cement	.45 per bag	.95 per bag	
Structural steel, not erected	.04 per lb.	.08 per lb.	100

The question of the increase in the cost of labour does not need much explanation, and for the purposes of the moment we will take it as having increased 100%. This figure, I think, will be accepted as being approximately right though perhaps it might be a little low when considering the fact that we are considering the entire range of labour. By that, I mean the wages of the moulders engaged in the making of the generator castings down to the laborer digging the power house foundation.

Fortunately, for the electrical industry, the great increases that we have just calculated have not actually been attained and the situation has been modified by such factors as the use of much larger generator units and transformer units, and also by the increased mechanical efficiency obtained in the more modern equipment; but, in spite of these factors the total cost of electrical undertakings has advanced as compared with previous years to not far short of three times what it was five or six years ago. This does not mean, however, that the prices of power should be increased by three times, but as the largest charges in hydro-electric undertakings are capital charges the power prices will certainly have to be increased at least 100%.

Quite a number of engineers and many purchasers of power will state that the price of power in the case of water power as having a normal price of say $15.00 per HP. per annum, or perhaps $20.00 per HP. per annum. As a matter of fact there is no such thing as a normal price for power. The cost of hydro-electric power for the past twenty years has practically, or since the commencement of the industry, steadily increased, and while one can theorize on what might be the normal price of power based on a rate of increase obtained from results of past years, there finally is only one price

that can be considered after all, and it is the price based on today's actual cost.

I have dealt briefly with how the present day cost of financing, materials and labour affect the cost of power from a new plant and it will perhaps be accepted by engineers on consideration that the newer prices of power at the power house are likely to be at the lowest not less than $20.00 per HP. per annum in the most favorable conditions of large capacity and cheap development.

I will now deal for the moment with the effect of newer prices of labour and materials on the cost of plants already in existence that were constructed before the war.

There are two main considerations in the sale of power from such plants. One, the effect of the newer costs as regards old customers, and the other the same as regards new customers.

In the case of the existing consumer of power we have a state of affairs where in the most favorable conditions the cost of power is affected mainly by the higher wages paid for the operators, patrolmen and maintenance men. These costs are in the neighborhood of about twice what they were five years ago, while in the case of materials depending upon voltage of supply the costs are to the extent of two to four times, as can be seen roughly in the table I have just given.

In the case of new customers the question of financing extension also becomes an important factor in the power charges and the same is true to a lesser extent where older customers' loads grow rapidly as is often the case.

I leave for the moment the question of the effect on the newer costs entering into construction and operation of power plants, and will consider such costs in connection with the relations between the power producer and the consumer.

Generally speaking, in past years the sale of power has been on the assumption that the co t of producing same was stationary, and contracts for power were often made with municipality or power users for a long term of years, and it can easily be understood that this condition has, in view of the higher costs, resulted in the producer having a number of very unremunerative contracts in force. This matter of increasing costs of materials in the case of steam plants, of course, has had to have attention with the result that amongst the steam power producers in the United States a large number of contracts with consumers, and also the prices authorized by the various State Utility Commissions, have made use of what is known as a "Coal Clause," which allows the price of power to be varied with the cost of coal.

One effect of this rising cost of power will, I believe, result in the more careful and closer measurement of the maximum demand, and also particularly the unit consumption, and thus what is known as the "combined rate" become the common method of measuring power. In other words, the hydro-electric kilowatt will, in future, be sold as a unit with a price, and a straight demand charge of so many horse power or kilowatts per month or per year, as the case may be, will disappear.

Curiously enough, the average power purchaser thinks that the price of power is a thing that should not raise, and that there is not reason for it to

do so, though the fact that during the last five years the purchasing power of the dollar had declined 50% of its former power. That alone almost justifies doubly the power price.

In conclusion, it will be seen that these notes have not dealt with the subject in detail, and that owing to the enormous range of conditions that obtain could hardly be read at the meeting of this association, but it will, I hope, serve the purpose of drawing attention of some of the engineers to some of the features involved in the sale of power, and perhaps cause further discussion on the subject.

Respectfully submitted,

R. J. BEAUMONT.

THE PRESIDENT:—I am sure we are all greatly indebted to Mr. Beaumont for the exceedingly interesting paper that he has just read. Looking at the subject on the next report which is to be presented to us, I think that any discussion which we might wish to make in reference to the paper which Mr. Beaumont has introduced, might quite fittingly be deferred until this next paper has been read. Mr. Davies having gone to Europe for a trip, I now call on Mr. Charles T. Barnes of the Toronto and Niagara Power Company to read the report of the Committee on Commercial Sales and Rates.

MR. C. T. BARNES:—I regret that the chairman of this committee, Mr. Davies, is not here to read the report, he being more familiar with it than myself.

REPORT OF THE COMMERCIAL SALES AND RATE COMMITTEE

Your committee has pleasure in submitting their report for the Convention of 1920.

This report is made up of a series of articles on matters with which the committee has found its members were conversant, as follows:

1. Electric ranges, water heaters, ovens, etc.
2. Sales of electrical appliances.
3. Brass furnaces.
4. Off-peak loads.
5. Seasonable loads and surplus power contracts.
6. Power factor.

ELECTRIC RANGES, WATER HEATERS, OVENS, ETC.

1. DOMESTIC INSTALLATIONS:—Now that the "High Cost of Living" has hit the coal pile with the consequent increase in cooking costs to householders using coal stoves as well as to gas range users because of the necessary rate increases which many gas companies have been forced to make, it is undoubtedly a propitious time for our member companies to consider carefully the advisability of fostering electric cooking.

The electric range has long passed its experimental stage and from the viewpoint of the user, its present state of development affords every reason to expect its more general adoption at an early date.

However, your committee hesitate somewhat to definitely advise either in favor of, or against the encouragement on the part of our member companies of electric cooking. This attitude is taken, not because of any doubt as to the benefits which our residential customers may enjoy through the use of electric ranges, but rather because the local problems of installation and current supply may be such as to render any general statement regarding its economic advantages to the central station, difficult to substantiate for the individual member company. We feel, however, that a brief outline of the more important points to which each member company should give its consideration, may prove helpful in formulating its policy with regard to the electric range and water heater business.

THE CONSUMERS' VIEW POINT

(*a*) COOKING COST COMPARISONS:—The average family of five will require an electric range having three or four top burners and an oven with two heating units with a connected load for the total range of about 7 kilowatts.

Such a range will rarely impose maximum demand in excess of 3 kilowatts, and its current consumption has been found to average consistently about 1 kilowatt hour daily per person or a total of 150 kilowatt hours per month for the average family. In a brief report it is difficult to determine upon an exact average cooking rate, but we believe this rate can be given conservatively as not more than 3cts. per kilowatt hour and possibly lower. Accordingly, the cost of electric cooking for a family of five should not exceed $4.50 per month and maybe less.

General data on the cost of gas cooking is not available. One of your committee however, has found by observation, that the average gas consumption for cooking purposes in his family of five is 4000 cubic feet monthly. Under present day gas rates of from $1.00 to $1.50 per thousand cubic feet, the cost of gas cooking averages from $4.00 to $6.00 monthly.

The same family utilizing a coal range requires from one half to three quarters of a ton of coal monthly. Basing this coal cost at $14.00 per ton, we find that cooking with a coal range costs from $7.00 to $10.50 monthly.

Accordingly it is seen there is but little difference, under present conditions, in the operating cost of electric and gas ranges, but that electric cooking is less than one-half as costly as coal.

(*b*) BENEFITS:—It is hardly necessary to devote attention to the acknowledged advantages which the user of an electric range is assured. Not only is its operation more convenient and healthful than any other method of cooking, but also the financial point of view again is brought to the fore. It has been well established that food cooked in an electric oven does not suffer shrinkage or evaporation to the extent that it does in the more poorly insulated gas and coal range ovens. That this lack of shrinkage has a direct financial benefit to the electric range owner can be demonstrated clearly under present day costs of meats.

CENTRAL STATION VIEWPOINT

Undoubtedly at the first glance it will seem proper for our member companies to encourage a load such as this, offering an outlet for approximately five times the kilowatt hours which the same household requires under normal conditions for its lighting. This attitude seems particularly desirable when, in addition to the large load waiting to be served, it can be proven to the consumer that the proposition is sound, economical and to his financial benefit.

There is an economic point, however, which the central station in justice both to itself and its customers, must not neglect to consider carefully; will the capital investment required to supply this type of load be so large as to prevent the assurance of profitable return accruing to the company? And, if so, should not the consumer be asked to contribute that part of the capital investment in excess of the amount which the central station can logically devote to his range installation?

The load factor of the individual electric range varies but little from that of the lighting installation in the same residence. However, it should be noted that most of the energy for cooking purposes is delivered during the day and in off-peak periods. While the stove load over-laps the lighting for a brief period at the time of the evening meal, it will be found as a rule, that the lighting load is not at its greatest during this time. The central station also obtains a further benefit due to the relatively high diversity factor which has been found to exist in a community where considerable electric cooking is done. In other words, while the individual stove represents a relatively heavy possible demand upon the lighting circuits, a number of such installations establish a combined demand very much less than the sum of the individual range loads. An instance may be cited of an apartment house in which there were 22 electric ranges with a total connected load of 97.14 kilowatts. The combined maximum demand was found to be 16.8 kilowatts which shows a diversity factor of nearly 6. It is readily appreciated to what a favourable extent such adversity factor affects the unit investment required for copper, transformers, meters, etc.

In this connection however, it should be pointed out that the value to our member companies of this diversity factor will not vary in direct proportion with the percentage of their customers who cook electrically. A comparatively small investment usually is all that is required to serve the first few cooking customers in any locality. As this load develops in any district, a saturation point will be reached in time, after which, for each additional range connected, the central station will find it necessary to increase its capital investment very materially in order to carry the added demand.

WATER HEATING

Consideration of electric cooking immediately brings into prominence the question of domestic hot water supply. Because of the fundamental difference in gas and electric water heaters, it is difficult to make satisfactory cost comparisons. The gas heater is of the instantaneous type and in electrical terms, may be classed as a high demand and low load factor in-

stallation. The electric water heater in general use is of the opposite or storage type being of comparatively low wattage, designed for continuous operation. The difficulty as to a satisfactory cost comparison is complicated further by the fact in the usual residence that the hot water supply in the colder months is obtained from a furnace coil.

There have been numerous ways advanced of meeting the hot water problem. One which has met with satisfaction both to the consumer and the company has been to install an electric circulation heater of from $\frac{3}{4}$ to 1 kilowatt capacity for continuous operation under a flat rate basis of billing. Another method which is in satisfactory operation is to connect the resistance unit of a circulation heater, by means of a double throw switch to either 110 or 220 volt service. This type of heater operates normally at the lower voltage and wattage under a flat rate, with provision for throwing the switch to the higher voltage and thus utilizing greater heating capacity for any abnormal hot water requirements. This high heat consumption is registered by the range meter and billed at cooking rates.

Still another water heating method has been favorably looked upon in the past and may be mentioned. In this arrangement the water heater is of medium wattage and both range and heater are connected to the supply circuit by means of a double throw switch so that their simultaneous operation is impossible. It is readily seen that this benefits the central station by lessening the possible maximum demand of the installation.

2. COMMERCIAL INSTALLATIONS:—The application of electrical heat is becoming increasingly popular in many industries. Such commercial installations as a rule, assure a higher net return to the central station than from domestic cooking, etc. This can be traced to various reasons such as the higher load factor at which such installations operate, as well as to the fact that the districts in which these loads occur, are served usually from power circuits with more spare capacity in copper and transformers than in residential neighborhoods. Further there is no new rate to be established as the existing power rate—usually some form of a demand charge plus a kilowatt hour rate varying with the load factor, is found equitable both for the company and the customer.

The bakery finds the modern bake oven very efficient for a number of reasons; the oven is under heat only while baking is in progress, due to the lessened evaporation because of the better heat insulation employed, it has been proved that less materials are required to produce a given quantity of baked goods from the electric oven than from the old type "fuel" oven. The electric bake oven usually built in two or three decks, occupies small floor space. It is interesting to note that it is more economical to bake three successive batches of dough in a comparatively small oven than to heat a large oven in order to complete the baking in one step. Such operation is naturally preferable both to the central station because of the increased load factor due to longer hour operation at lower maximum demand and to the baker on account of the lower oven cost.

Hotels, restaurants, clubs, hospitals and other institutions are cooking electrically on an increasing scale and for no other reason than because it is sound business for them to do so. The restaurant proprietor appreciates the

economy of an electric broiler ready for instant service in contrast with his former necessity of maintaining a continuous fire for serving an occasional order. The kitchen employees appreciate the installation of electric cooking apparatus because of the resultant cooler temperature and cleaner surroundings. Last but by no means least, the restaurant patron is glad to frequent an establishment sufficiently up-to-date and progressive to install such equipment for he realizes he will obtain a superior meal prepared under the most sanitary conditions.

In manufacturing establishments electrically heated equipment is now standard in almost unlimited applications. Among some of the more recent applications employing fair-sized blocks of power may be mentioned the conversion by a firm making typewriters of some of their gas-fired, Japan-baking ovens to electrical heating. In the automobile industry large installations of electric ovens have been made for baking the Japan on car bodies, hoods and fenders.

Core ovens in foundries are now being heated electrically and the results are satisfactory due to the practically perfect heat control possible in an electric oven.

An interesting and somewhat larger application of electric heat offering possibilities for the sale of comparatively large blocks of power was developed and placed in successful operation about 18 months ago. This consists of large heat treating ovens, or more properly furnaces, in which cast steel anchor chains, crank shafts for air plane motors, etc., are annealed electrically. The heating effect is obtained by resistance by passing electricity through carbon electrodes to troughs on the furnace floor constructed of carborundum fire-sand and filled with granulated carbon. These furnaces are of quite large capacities—600 kilowatts for the hardening furnace and 300 kilowatts for the drawing furnace, designed for tempering up to 3½ tons of material at a time. Various smaller applications are regularly being made and your committee believes a first class discussion with benefit to all is in order on this point, most of us have something to tell of successful recent applications.

CONCLUSIONS

(a) Domestic Installations:—In view of the different local conditions existing in our various communities, your committee, as stated above, does not believe it best to suggest a general policy with regard to electric cooking. Local conditions in each case should govern the policies of our various member companies. There is a doubt as to whether this business is always profitable to the central station. By investigating circuit conditions in each locality and analyzing the probable range and water heating loads in a district, our member companies may decide for themselves as to the value of such business to them.

(b) Commercial Installations: It is felt that our member companies should encourage electric heating applications among their local industries. Such commercial installations will usually be found to operate at reasonably high load factor. Under existing power rates and the usual circuit conditions in a manufacturing district, the revenue will be found to well warrant the expense of obtaining such business.

THIS IS THE PSYCHOLOGICAL TIME TO BOOST THE SALES OF ELECTRICAL APPLIANCES

PROGRESS, CHANGE, is the by-word of the day. People everywhere are alive to new things, and in the industry in which we are engaged this is possibly more in evidence than in any other. Change is in the air. New ideas are coming to the front. All these changes mean varied opportunities for those who are keenly awake to the possibility of the times, being ready to grasp them. Throughout Canada today the scarcity of domestic help, the scarcity of, and the price of fuel, are the dominating factors in boosting the sales of electrical household labour-saving devices, in fact to such an extent that manufacturers and supply houses are called on to put forth their best efforts to supply the demand.

Business at the present time is coming so easily, is obtained with so little effort, that there is the gravest sort of danger that individuals or business concerns may credit themselves with an undue proportion of business acumen. The fact of the matter is that money has been so plentiful and the public have been so saturated with a dominating desire to spend, that no great ability is required to dispose of electrical appliances in any form. The dangers of such a condition are grave and great. Men are inclined to over-rate their earning powers. Sales managers are apt to overestimate their abilities. The ease with which sales are made may lead to over production or over buying.

The year 1920 will probably be a banner business year, but with labour troubles marked by ever increasing numbers of destructive strikes, the coming year may be one of upleasant surprises. The thing that is certain,—the bet that is a two-ply cinch,—is that right now is the best time to sell, in fact, the best time that any of us have ever known. This is not the time to be satisfied with business that comes to us naturally. It is a poor time to stand behind the counter and wait for customers to come in, even if they are coming in, in surprising numbers and with surprisingly open purses. The time to sell is while the going is good. This is the time to dispose profitably of any surplus stocks. This is the time to push and plan big sales. This is the time to go after business. This is the time to keep your whole selling staff and if possible to increase it. This is the time to trim windows temptingly, to use more newspaper space in a more intelligent manner. This is the time to hold sales meetings of your employees and put into them the "pep" of a great opportunity. It is a very safe prediction that before many years have passed we will all be referring to the year 1920 when it was so easy to sell appliances. Pounding a cold iron never made a good plow share. Strike while the metal is hot. This is the best selling time the world has ever seen. Don't fall asleep at the switch. Get busy and get your share. The majority of us here have no doubt heard Bill Goodwin tell the electrical fraternity how to sell merchandise properly and profitably, and we can all take a leaf from his book with profit to ourselves.

The fundamental principles of advertising is to create,—Interest, Desire, Action —and ultimately produce sales, and the buying motives are—Gain, Necessity.

PRIDE, FORESIGHT AND LUXURY

The best form of advertising, provided that you have a suitable location and good windows of course, is proper window display, 80% to the eye, 20% to the ear. The next best form of advertising in order to create demand is judicious newspaper advertising which should be done regardless of your location, windows, etc.

The successful advertising campaign must be planned far ahead and allowance must be made for every influencing factor, "favourable or unfavourable" and through all the idea must remain uppermost, and the campaign has but one object,—to sell electrical energy at a profit. Close co-operation with the sales department is essential and to assure success, the sales and advertising departments should work together as one unit, for it is just as possible for one department to completely nullify the work of the other by lack of harmony as it is possible for both to more than double their efficiency by careful coordination of effort.

Advertising and good salesmanship do not conflict in any way, on the contrary skilful advertising must be of great assistance to the salesman.

TEST OF AN ADVERTISEMENT

A good advertisement must satisfactorily answer five questions:—

First:—Will it attract the attention of the consumer it is intended to reach?

Second:—Is it specific?

Third:—Is it forcible?

Fourth:—Is it plausible?

Fifth:—Is it sincere?

No piece of copy should be allowed to go to press which does not answer these questions. In writing copy it should be borne in mind that the reader of a paper does not primarily desire to read the advertisements and it is almost against his will that his attention must be attracted and held until the story is closed.

Study of skilfully composed advertisements will show that when the attention has once been attracted to the first line it is difficult to stop reading until the whole story has been absorbed.

CO-OPERATION

The spreading of the gospel advocating the forming of "Electrical Clubs" in the different localities and boosting of the "Get Together Spirit," is something that should be encouraged. The greater the number of contractors and dealers that have appliances on sale, the greater the number of appliances that will be sold. Therefore it is opportune to encourage wiring contractors, departmental stores, hardware dealers and other merchants either directly or through the manufacturers of appliances to engage in this business. Devote particular attention to small contractor-dealers with a view of putting them on a more profitable basis.

More use should be made of the telephone by appliance departments, as a great many sales can no doubt be made in this way. Vacuum cleaners, and washing machines should be featured on the installment plan, adding at

least 10% to the cash price to cover the cost of collection, accounting, etc. Regarding the sale of heaters, central stations throughout the country and especially throughout Ontario today are feeling the effect of the enormous sale of heaters which is not only affecting the peak load of the Central Station which of course is only during the winter period, or Spring and Fall but also on their distribution system where they have found it necessary to make changes in their circuits and increase the size of copper, and it will be necessary for all central stations to protect themselves wherever possible by having a large enough "standby" "readiness to serve" or "installed capacity" charge, to look after this class of business. The domestic lighting rates as applied by a number of companies is based first on an area or room charge which in the majority of cases is absolutely inadequate to take care of heating loads of more than one lampsocket heater.

Keep on boosting, but keep in mind that the profit on heaters sold of more than 660 watts is not worth while if the electrical energy required to operate them is to be sold at a loss to the company. We are increasing the income by selling more appliances and by encouraging the use of appliances now owned by customers. The appliance load with the exception of the heater has a high diversity factor and a lot of it is "off peak".

In conclusion there is no doubt that every central station company in this country can improve the density of its load by a more vigorous campaign for the appliance business.

ELECTRIC BRASS FURNACE

Electric brass melting is an open field for most power companies, as only one furnace is so far in operation in Canada.

Some idea of the field can be drawn from a comparison with figures showing the development in the United States. In a recent pamphlet it was stated that the amount of brass being melted electrically in the United States at the end of 1919 was one per cent. and that this was taking 20,000 k.w. If this were expanded to say 90 per cent. which is considered a possible figure in the present state of the art, the demand would be increased to 1,800,000 k.w. Taking the comparison of population with Canada this would give about 160,000 k.w. of available demand in Canada.

Any community of a reasonable size has its brass foundry, or a brass foundry as a part of some industrial establishment.

Electric furnaces for brass melting are made in comparatively small units, furnaces for handling 300 lbs. of metal being obtainable. Under these conditions the smallest of brass foundries can use constantly one or more furnaces to advantage.

From the electrical point of view the load is a desirable one, having high load factor without excessive peaks, the consumption running from 225 to 300 hours per ton on medium size furnaces, the demand being from approximately one k.w. for six lbs. of metal for smallest sizes to one k.w. for 35 lbs. of metal of medium size.

The brass melting furnace has developed rapidly during the last two years and it is in every way a commercial success.

Furnaces are generally single phase of the Resistor type or Arc type. Recent practise is toward rocking, rotating or undulating the furnace during the melting period so as to prevent the distillation of the zinc contents, and to prevent also unequal heating of the surface of the metal.

According to figures available from the manufacturers a price of 1½c. per k.w. hr. is quite low enough to make the electrical melting of brass much more economical than the cruciable coke-fired or oil furnaces.

The melting time is generally about 1 hour and allowing time for charging and pouring, 6 heats per day can be obtained in 9 hours. From the Central Station point of view one of the special advantages of this load is, that it can usually be obtained "off peak".

The following comparison taken from the guaranteed cost of operation by one of the manufacturers leaves no doubt as to the relative economy: -

BASIS OF COMPARISON	Coke	Oil	Electric
1200 lbs. coke at $9.00 a ton, (delivered)	$5.40	$....	$....
50 gals oil at 7c. (delivered at furnace)	....	3.50	....
500 K.W.H. at 1½c.	....	....	7.50
4% Metal loss at 15c. lb.	12.00	....	.
5% Metal loss at 15c. lb.	....	15.00	
1½% Metal loss at 15c. lb	....	....	4.50
Crucible No. 80 (20) heats	6.50	....	
Renewals and Repairs	....	.50	.50
Total cost per ton of Melt	$23.90	$19.00	$12.50

Photographs of three of the main types are shown: Fig. 6 being of a Resistor type, single-phase. This furnace is made 3-phase for units over 100 k.w. Has a steady load, no peaks and a power factor of over 95%. Figs. 7 and 8 of a rocking type, single-phase and Fig. 9 of an undulating type, 3-phase.

The furnace shown in Fig. 9 is made in Canada.

The main features claimed for the electric brass furnaces are:—

1. Metal saving. (See table, page 81) 3 per cent. in favor of electric.

2. Improved quality and uniformity of metal.

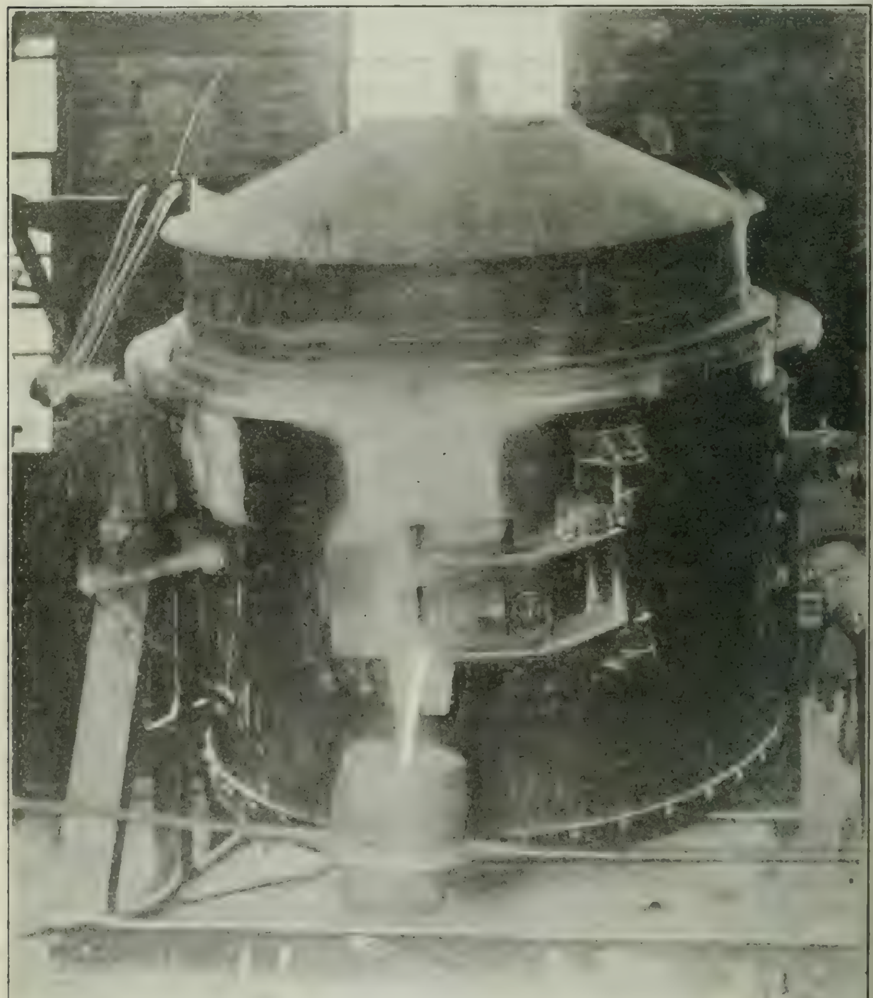
3. Exact temperature control. No burning of metal.

4. Increased production due to high speed melting.

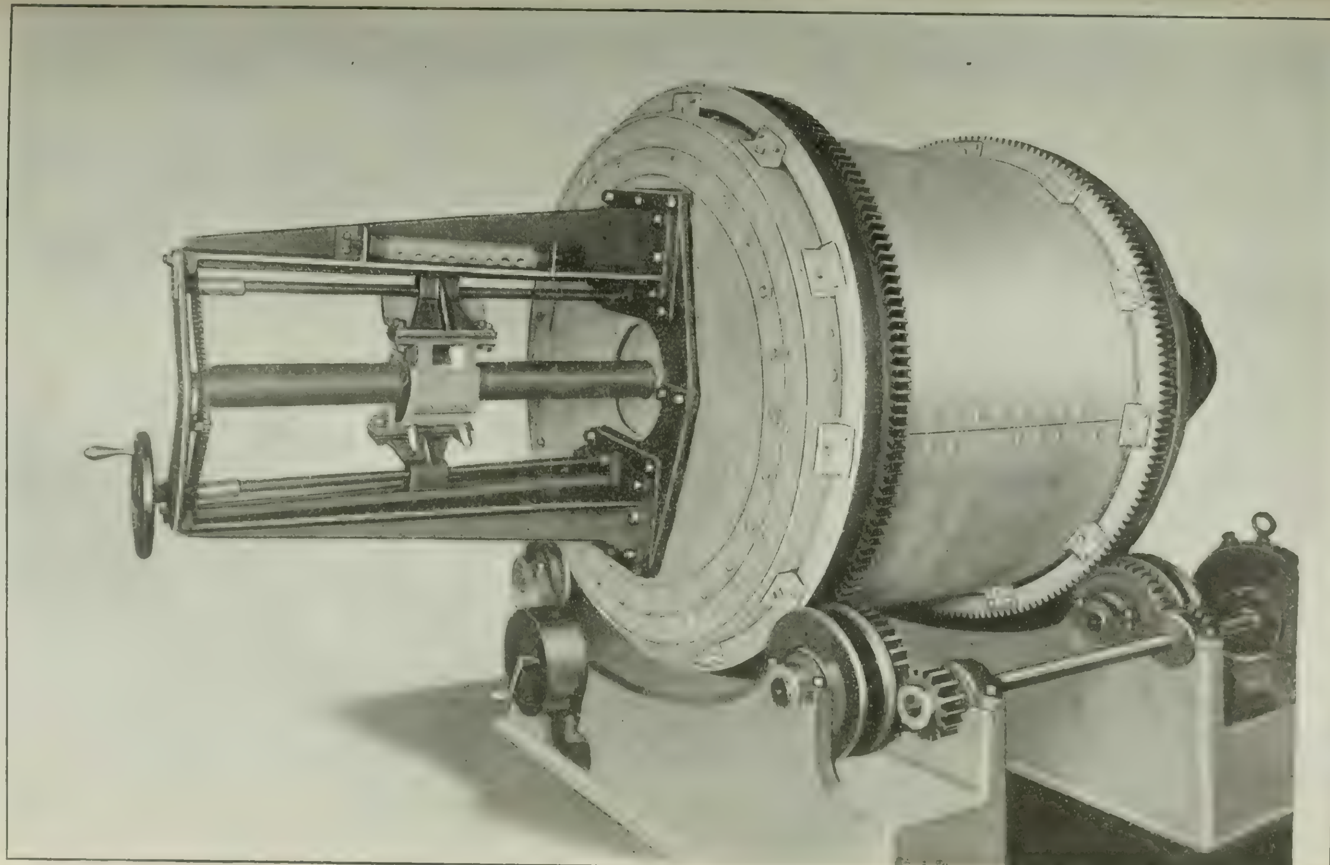
5. Increased size of single melts, allowing largest castings to be made from one pouring.

6. Economy of floor space and cleanliness of operation.

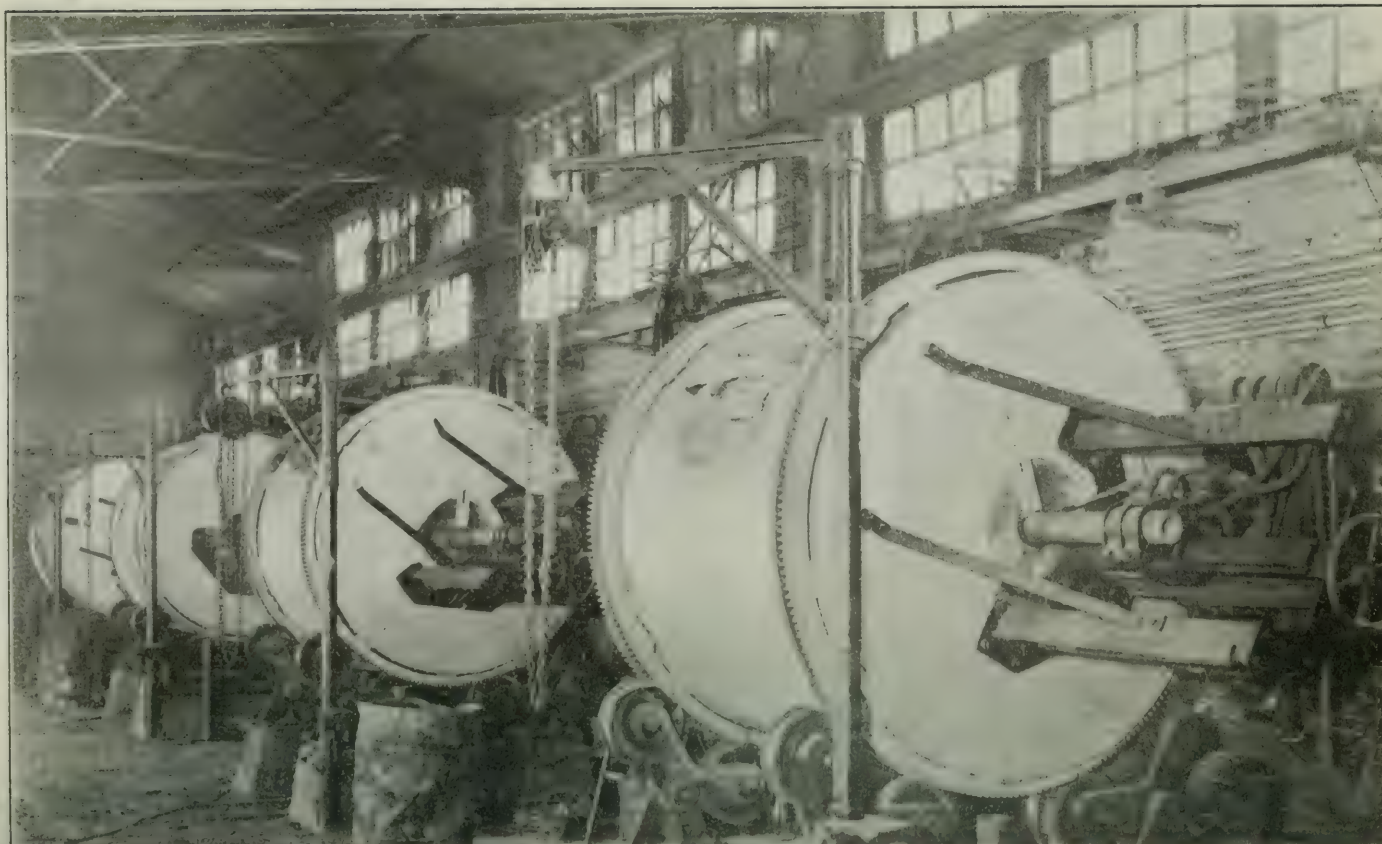
7. Vastly improved working conditions for the help due to lack of fumes, heat and noise.



(Fig. 6)



(Fig. 7)



(Fig. 8)

(Fig. 9)

OFF-PEAK LOAD CLAUSES IN LARGE POWER CONTRACTS

Generally speaking, we believe the average Central Station can well afford to spend a little time in thoroughly analyzing the operating conditions of the plants of its large power consumers, with a view, where circumstances will permit, of having incorporated in their power agreements some restriction in the amount of electrical energy that may be taken at the time of the Central Station's peak load.

It is realized, of course, that some power companies, owing to their power situation, have a clause in all their agreements giving them the right to limit the amount of energy that may be taken by the consumer during the peak period—usually from 2 to 4 hours a day—other companies, however, have not bothered much about imposing such a restriction, possibly hesitating to do so for fear that adequate service would not be extended to the consumer.

The inclusion of an off-peak clause can generally be amicably arranged with the officials of large industrial concerns, provided the matter of the power situation is intelligently gone into. Obviously, the Central Station does not wish to impose restrictions which would put any of its customers "out of business" even for an hour or so a day, such an attempt would probably mean, in some cases at least, the consideration by the prospect or consumer of the installation of an isolated plant, but by carefully setting out the facts of the case and going fully into the consumer's operating conditions, ways and means may often be devised to meet the situation of the curtailment, by a certain percentage of their total power requirements, when the saving to be effected by accepting a lower rate is taken into account. Just what reduction in rate should be extended in consideration of an off-peak

clause depends naturally on the value of same to the individual power company affected, generally, we believe, a discount of 10 to 20% would not be out of the way.

It is quite certain that there are a number of consumers with quite large loads who would be willing to consider the placing of an off-peak clause in their agreement.

In a country so full of opportunity as Canada, a heavy demand for electric power to meet the future needs of industrial development seems practically certain, yet caution should be exercised before large capital expenditures are undertaken, unless local conditions make such a step imperative, for while the outlook is promising, the extremely high costs of developing additional power at the present time would probably lead to an increase in rates to the consumer; there is also the possibility, owing to the unsteadiness of general conditions, that a quiet period may be encountered, with a consequent dropping off of some industrial loads. These are matters which must be carefully weighed and it is felt an endeavour made to postpone at any rate for the time being, the necessity of developing more power, and this object may possibly be attained by adopting in power agreements the subject of this article the "off-peak" clause; where a central station finds its load climbing so high that the peak is approaching the plant's capacity the right to exercise such a provision is particularly desirable at these times, for if the plant's peak can be smoothed down by some thousands of kilowatts, it may prove to be an extremely valuable matter in respect to the cost of generated power.

Your committee sent out a questionnaire, and although the expense was limited, the answers received indicated that the matter of "off-peak" loads is a very live one, and that it is possible to delay capital expenditures on plant by arranging with existing customers to contract their demands on peak, without creating any marked hardship. The eight-hour day, in conjunction with the effects of the street railway operators to stagger working hours, may prove an automatic solution.

SEASONAL LOADS AND SURPLUS POWER CONTRACTS

There are always some exceptional loads offering, if the Central Station Power Sales Organization will keep alive to the possibilities of grappling with extraordinary conditions and bend every effort to secure such loads, which will in many instances not add to the capacity of the power plant, such is indeed ideal business and such advantageous loads should be strenuously gone after, for we in the business realize that we have many demands from the small ordinary consumer for service for lighting and power purposes which we have to supply and where the business taken on has little or no profit in it; it is to balance matters more evenly that "seasonal" loads, or if possible, surplus power contracts should be secured.

Among the seasonal loads are such as brick and tile making and other clay products, which plants usually operate only in the summer months, also ice making, pumping plants for irrigation purposes, these loads and others can all be secured for from 4 to 6 months and will not, (if the plant's peak is in the winter) add to capacity. There are also in quite a number of cities large isolated plants installed and where the question of the supply of steam

heat has probably been the reason why the Central Station has failed to secure the lighting and power load; it can be shown in many instances, that for from 4 to 6 summer months, when steam heat is not required, that it would be far more economical to shut down their own private plant during such period and take Central Station service, this again being a seasonal load and not bothering the winter peak.

If an agreement can be arranged for purely Hydro-Electric surplus power for electro-chemical or electro-metallurgical industries, the rates for such class of business would be quite profitable at from $10.00 to $15.00 per k.w. year, depending on locality and such low rates would attract the business. Under such conditions as surplus power supply, it should, of course, be provided that the consumer shall provide all transformers, electrical plant and equipment and construction work necessary, in other words the power company would not spend any money to secure such business. The term "Surplus Power" would have to be very clearly and definitely understood to mean that it is such electrical energy as may be available or estimated to be available after the power company has fulfilled and furnished any and all of the requirements for electrical energy for its own use, or those of its present or future customers, and would not include any energy available from steam reserve plants, etc.

POWER FACTOR

The question of penalizing customers for low power factor loads has been a much discussed one for some time, both as to its advisability and as to methods.

From an isolated practise five years ago it has now become a general practise, and rightly so.

The increasing costs of material of all kinds has certainly put a premium on good power factor.

The following consideration clearly shows the necessity that power companies shall be paid for the capacity of apparatus employed for service to customers.

Consider the question of handling a load of 500 K.V.A. 80 per cent. power factor, 8 per cent. drop for a distance of one mile from a power plant, the size of wire No. 0, service 3-phase, 2200 volts. Five years ago the cost per K.V.A. was about as follows for fair sized plants:—

Generators and switchboard equipment	$20.00 per k.w.
One mile of line $1500.00	3.00 " "
Transformer to 550 v.	5.00 " "
Total	$28.00 per k.w.

Today the price is as follows:—

Generators and switchboard equipment	$60.00 per k.w.
Line	7.00 " "
Transformer	10.00 " "
Total	$77.00 per k.w.

This comparison is made even worse by the fact that new ratings of apparatus on a 55 degrees temperature rise have not the same capacity as the old apparatus on a 40 degrees rise.

Every k.w. saved in line transformer and generator capacity is worth from 2½ to 3 kilowatts at present prices, and if poor power factor apparatus uses up capacity which necessitates replacement, sooner or later it certainly must pay for the accommodation.

Again, a line which would give acceptable regulation at 85 or 95% power factor will not do so at 50 to 60% power factor, as will be seen from the following table:—

Load 500 K.W. Distance 1 mile. 2200 V. delivered. 3 No. 0 Wires. 18-60 V.

Power Factor	Amperes	Resistance Drop	Reactance Drop	Generated Volts	Received Volts	Loss in Volts	Loss % Generated
100%	131	135	161	2340	2200	140	6.3
90%	145	150	176	2421	2200	201	9.15
85%	154	159	187	2440	2200	220	10.0
80%	164	170	198	2460	2200	240	10.9
75%	174	180	211	2480	2200	260	11.8
70%	187	193	227	2500	2200	300	13.7
65%	201	208	244	2520	2200	320	14.5
60%	218	226	264	2542	2200	342	15.5
50%	262	271	318	2617	2200	417	19.0

The question of correction of power factor comes within this committee's report, in as much as it is usually a function of the new business departments to advise a customer of delinquency in regard to power factor, and to consult with him as to a remedy. In this question of correction several manufacturing companies are now specializing in the supply of synchronous self starting condensers for floating on the customer's line.

Under the normal industrial load of 70% power factor such apparatus will pay for itself out of savings on the customer's bill in a short period of time, providing a suitable low power factor penalty is applied.

There have recently been developed and placed on the market static condensers of sizes which will take care of power factor correction for loads up to 1000 K.V.A., these condensers having an efficiency always exceeding 99.5% with no maintenance or attention required.

A published table shows the wattless component of 100 k.w. load at different power factors, and from this table can be determined the size of static condenser needed to raise the power factor from any one percentage

Errata in equation at bottom of page 88. C.E.A. Proceedings 30th year.

$$\text{Capacity in Mf.} = \frac{32.90 \times \text{Wattless component.}}{\text{frequency per sec.}}$$

Power Factor Cos. Ø	Wattless component per cent. of		Power Factor Cos. Ø	Wattless component per cent. of		Power Factor Cos. Ø	Wattless component per cent. of	
	Apparent load of K.V.A. Sin Ø x 100	True load or K.W. Tan Ø x 100		Apparent load of K.V.A. Sin Ø x 100	True load or K.W. Tan Ø x 100		Apparent Load or K.V.A. Sin Ø x 100	True load or K.W. Tan Ø x 100
1.00	0.	0.	.79	61.30	77.6	.58	81.46	140.4
.99	14.09	14.23	.78	62.55	80.2	.57	82.16	144.1
.98	19.91	20.3	.77	63.81	82.9	.56	82.85	148.0
.97	24.33	25.1	.76	65.00	85.5	.55	83.51	151.8
.96	27.98	29.18	.75	66.15	88.2	.54	84.17	156.0
.95	31.25	32.9	.74	67.26	90.9	.53	84.80	160.0
.94	34.12	36.3	.73	68.32	93.6	.52	85.41	164.2
.93	36.73	39.5	.72	69.40	96.4	.51	86.0	168.6
.92	39.20	42.6	.71	70.42	99.2	.50	86.60	173.2
.91	41.45	45.6	.70	71.40	102.0	.49	87.18	177.9
.90	43.60	48.4	.69	72.37	104.9	.48	87.73	182.8
.89	45.57	51.2	.68	73.30	107.8	.47	88.27	187.8
.88	47.48	53.96	.67	74.22	110.8	.46	88.79	193.0
.87	49.32	56.69	.66	75.13	113.8	.45	89.31	198.5
.86	51.03	59.3	.65	75.98	116.9	.44	89.80	204.1
.85	52.67	62.0	.64	76.84	120.0	.43	90.27	209.8
.84	54.26	64.6	.63	77.66	123.3	.42	90.75	216.0
.83	55.77	67.2	.62	78.46	126.5	.41	91.21	222.5
.82	57.23	69.8	.61	79.24	130.0	.40	91.65	229.1
.81	58.64	72.4	.60	80.0	133.3	..	....	....
.80	60.00	75.0	.59	80.75	136.9	..	....	..

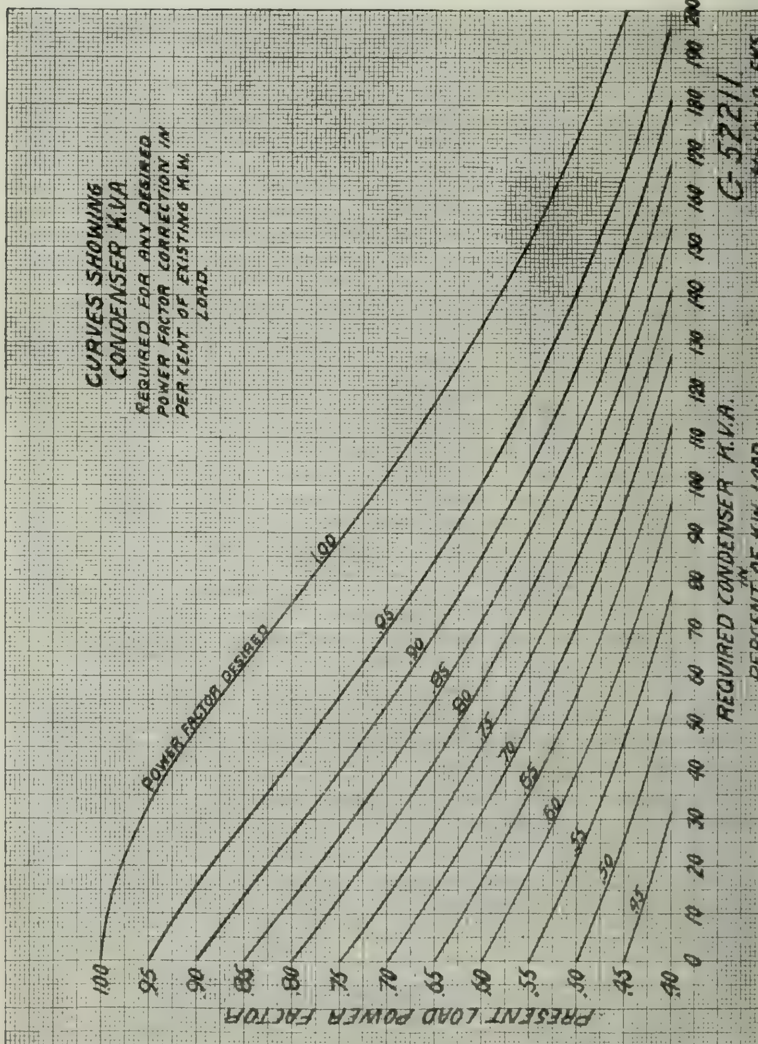
Take an example:—Supposing 100 k.w. 60 cycle load working at 60% power factor is required to be raised to 85% power factor. From the Wattless Component at 60% power factor equals 133.3 K.V.A. Wattless Component at 85% power factor equals 62.0 K.V.A.

Therefore the amount of Wattless K.V.A. to be neutralized equals 71.3

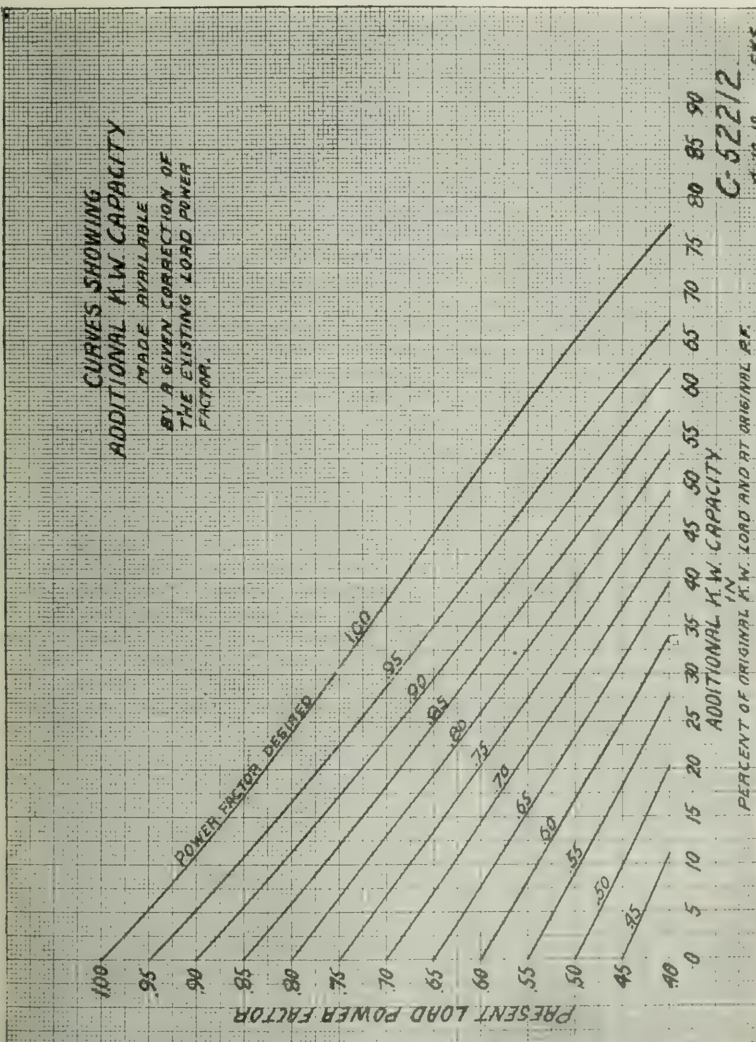
Errata in equation at bottom of page 89 C.E.A. Proceedings 30th year.

$$= \frac{32.90 \times 71.3}{60} = 39.09 \text{ Mf.}$$

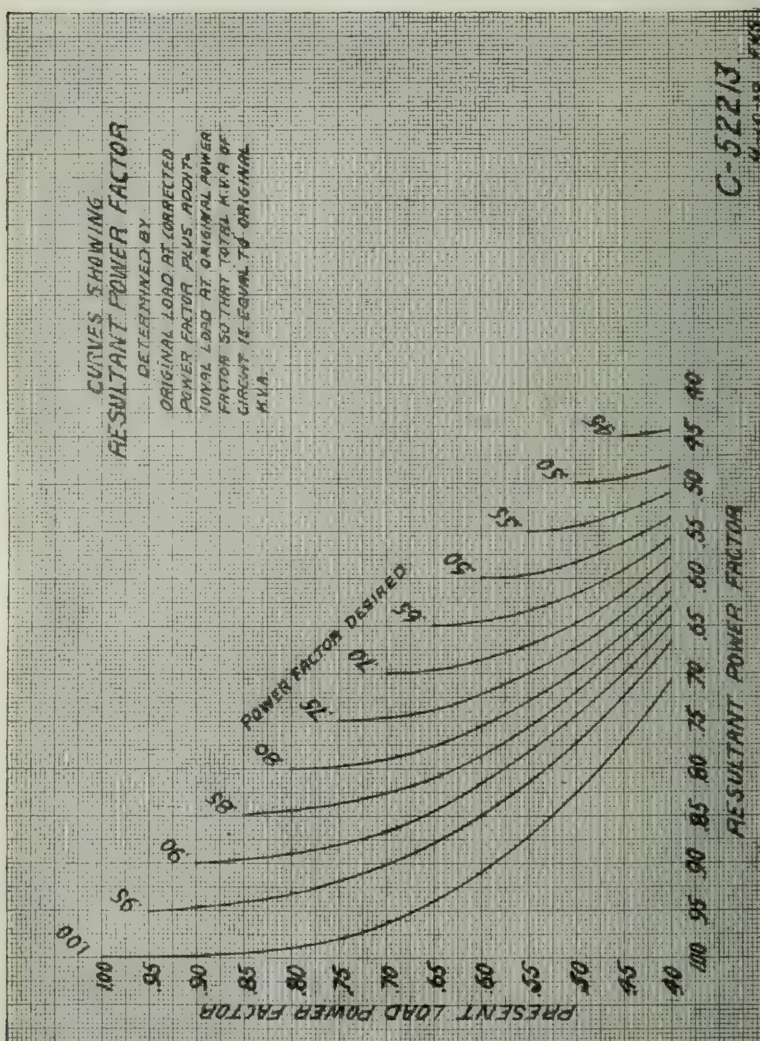
Your committee desires to call the members attention to a paper by O. C. Roff, General Manager of the General Electric Co., Philadelphia, partly extracted in the "Electrical World" of February 17, 1920, on static condensers, from which the following curves are extracted, with his permission


CURVES SHOWING CONDENSER K.V.A.
REQUIRED FOR ANY DESIRED POWER FACTOR CORRECTION IN PER CENT OF EXISTING K.W. LOAD.
POWER FACTOR DESIRED
1.00
.95
.90
.85
.80
.75
.70
.65
.60
.55
.50
.45
PRESENT LOAD POWER FACTOR
1.00 .95 .90 .85 .80 .75 .70 .65 .60 .55 .50 .45 .40
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
REQUIRED CONDENSER K.V.A.
IN PERCENT OF K.W. LOAD
G-52211

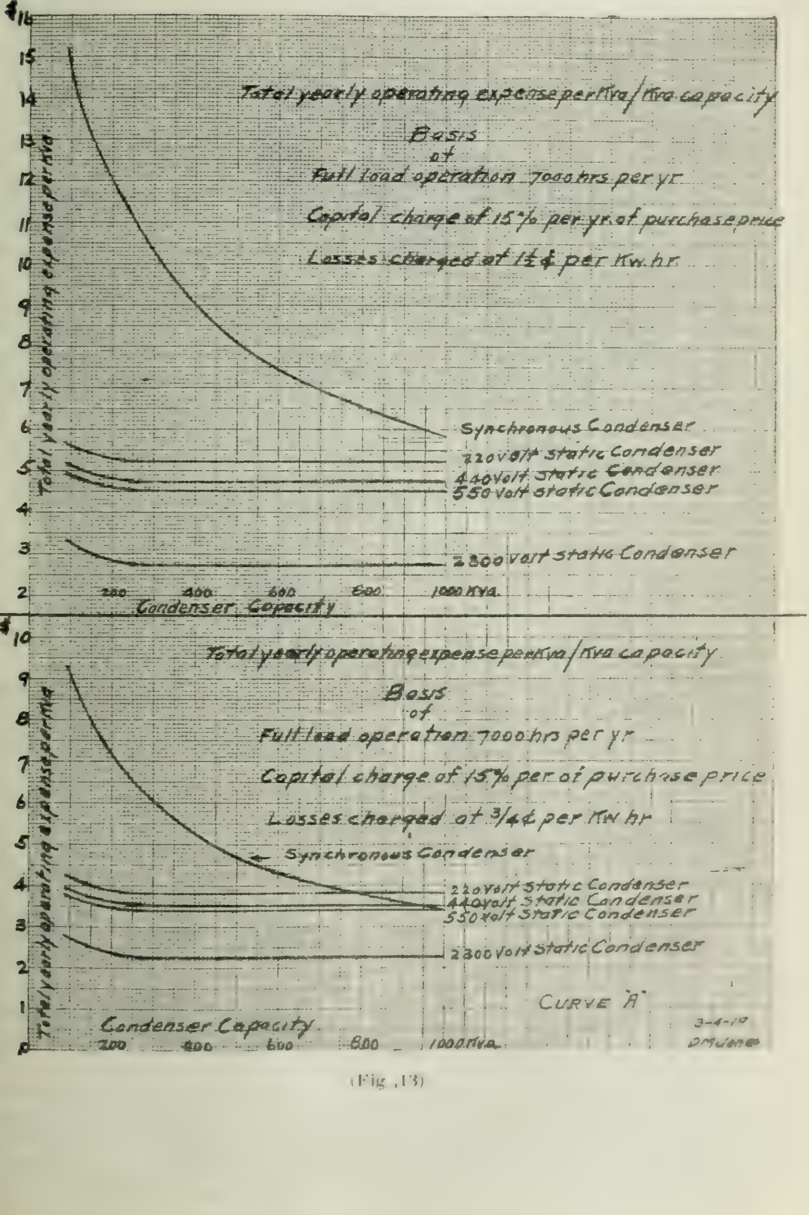
(Fig. 10)


CURVES SHOWING
ADDITIONAL K.W. CAPACITY
MADE AVAILABLE
BY A GIVEN CORRECTION OF
THE EXISTING LOAD POWER
FACTOR.
POWER FACTOR DESIRED
1.00
.95
.90
.85
.80
.75
.70
.65
.60
.55
.50
.45
PRESENT LOAD POWER FACTOR
1.00 .95 .90 .85 .80 .75 .70 .65 .60 .55 .50 .45 .40
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90
ADDITIONAL K.W. CAPACITY
IN
PERCENT OF ORIGINAL K.W. LOAD AND AT ORIGINAL P.F.
C-52212
4-10-19 EMS

(Fig. 11)


CURVES SHOWING
RESULTANT POWER FACTOR
DETERMINED BY
ORIGINAL LOAD AT CORRECTED POWER FACTOR PLUS ADDITIONAL LOAD AT ORIGINAL POWER FACTOR SO THAT TOTAL K.V.A OF CIRCUIT IS EQUAL TO ORIGINAL K.V.A.
POWER FACTOR DESIRED
RESULTANT POWER FACTOR
PRESENT LOAD POWER FACTOR
C-52213

(Fig. 12)


Total yearly operating expense per Kva/Kva capacity
Basis
of
Full load operation 7000 hrs per yr
Capital charge of 15% per yr. of purchase price
Losses charged at 1½¢ per Kw. hr.
Synchronous Condenser
220 volt static Condenser
440 volt static Condenser
550 volt static Condenser
2300 volt static Condenser
Total yearly operating expense per Kva
Condenser Capacity
200
400
600
800
1000 Kva.
Total yearly operating expense per Kva/Kva capacity
Basis
of
Full load operation 7000 hrs per yr
Capital charge of 15% per of purchase price
Losses charged at 3/4¢ per Kw hr
Synchronous Condenser
220 volt Static Condenser
440 volt Static Condenser
550 volt Static Condenser
2300 volt Static Condenser
Total yearly operating expense per Kva
CURVE "A"
Condenser Capacity
200
400
600
800
1000 Kva.

(Fig .13)

The curves are self-explanatory—figure 13 showing that in sizes under 1000 K.V.A., taking losses at 3/4 cts. per K.W.H., a synchronous condenser is more costly to operate than static condensers.

The old question of the method of determing power factor of consumers load is still open, but it seems probable that the two meter method of determining the average power factor will continue to be applied for small loads and graphic methods for larger loads which want expensive instruments.

The time may not be far distant when K.V.A. and K.V.A. hrs. will be the basis of billing and 100% power factor required; in fact with the present high initial cost of developing and distributing electricity and the fact that 85% of all costs in delivering electricity are fixed, it would seem almost time for companies to be paid for the capacity of apparatus used to supply the customer, and not for the horsepower imposed on the water wheels or other prime movers by the customers load.

In conclusion your committee hopes for a live discussion; the greatest value of a report to the members of this Association is often found in the discussion called into being. Let the other fellow know your experience, and don't be afraid to criticize the report. Your committee wants the whole truth.

Respectfully submitted,

CHAS. T. BARNES.	W. H. MCINTYRE.
M. C. GILMAN	L. W. PRATT.
S. T. HALLS.	J. B. WOODYATT.
R. B. MACDONNOUGH.	P. T. DAVIES, *Chairman.*

MR. BARNES—I move the adoption of the report.

THE PRESIDENT:—Mr. Barnes moved the adoption of this very interesting report. Will some one second it?

MR. GEO. K. MCDOUGALL:—I have great pleasure in seconding this report.

THE PRESIDENT:—Any observations that you wish to make, kindly make them quickly and tersely.

DR. L. A. HERDT:—Mr. Chairman, I have a few remarks to make on the report which has just been read from the committee on Commercial Sales and Rates.

This committee is now recommending that the method employing two single phase watthour meters be used to measure the average power factor of the consumer's load on three phase systems.

Power factor clauses inserted in power contracts, state that the average power factor of consumer's load shall not be less than x % as shown by reading of watthour meters, the time to extend over a period of say one month.

It is quite true that when a three phase load is balanced the total watthour consumed in a circuit can be measured by two watthour meters during a given time, and that a so called average power factor can be determined from such readings, but this value of cos. φ is not an average of the instantaneous values of power factor during the time taken, but is simply a factor.

which when applied to the kilowatt hour load taken by the customer, will determine how many reactive Kilo-Volt-Ampere hours have been delivered. This average power factor, however, applied over a long period of say one month, gives no indication whatever of the power factor of the load of the consumer.

Power factor is a ratio, not a quantity and averaging the power factor, as stated above has no meaning whatsoever. Used as a basis for determining the penalty a customer must pay is arbitrary, incorrect and should not be used.

The correct definition of power factor is the ratio of watts to volt-amperes. If a customer shows power factor as determined above, to be below a guaranteed amount, a penalty is legitimate, but to apply a factor determined by watthour meters over a long period is incorrect and unjustifiable.

A customer operating every day during the working hours at a high power factor, but who operates at night on say half load conditions would at the end of the month show a low energy factor or a low so-called average power factor.

The subject of accurate power factor metering is an important one; the power company's object should be to force a customer to operate at high power factor when operating under maximum load conditions. The power factor clause in the old contracts was a clause to protect the power company from use of poor apparatus or electrical equipment working considerably under rating. The new clause which penalizes the customer for operating under the so-called average power factor is not justifiable.

The power company finds this method very convenient. It may be convenient, but it is wrong.

I claim the words used "average power factor determined by the reading of single phase watthour meters" mean nothing. Contracts using such terms are manifestly incorrect.

The President:—We are very much indebted to Dr. Herdt for his valuable remarks.

Mr. Lincoln:—I can always talk on this subject. I quite agree that the term "average power factor" does not have very much significance and that its only reason for existence is because we can measure - take our existing apparatus and measure—and it is about the only thing we can measure and get to anything by which we can arrive at anything which depends upon the power factor of the circuit. That is the only thing we have available today. Now, I hope that that condition will not continue to exist, but that is the condition that we have today. Personally, I believe that our rates should be based upon the measurement of maximum demand and that the maximum demand should be measured in K.V.A. I wish there was some convenient cheap way to measure maximum demand in K.V.A. I do not know of any, and I do not know how to get it. It can be measured and I hope in the course of a year or two to produce some device which will measure maximum demand in K.V.A. However, that device is bound to be a rather expensive instrument.

I was very much interested in the report which showed the rising costs of our power. I had not realized that the costs had risen to the extent which was pointed out, but I must say that I fail to see any error in the proposition that was presented. It is well known that the costs of the apparatus and

equipment to produce our power, have risen from two to three times, what it was before the war and it is also well known that the fixed charges, interest particularly has gone up about 50%. The prevailing rate of interest before the war was 6%, the prevailing rate of interest today is 9%. So that the total fixed charges, which is the entire cost of water power, have gone up somewhere in the neighborhood of three to five times what they were four or five years ago. I do not see that there is any hole in that argument, and it is really astonishing when we come to look at that. Now, the companies producing power certainly cannot themselves carry that burden. They must necessarily pass that burden on to the users of power. There is no other method. The power costs to the ultimate consumer must necessarily go up, and I think it is highly important that in passing those costs on to the ultimate consumer we should use and adopt methods of rate making which are logical and which will pass that burden on to the ultimate consumer in a manner so that the burden will be justly distributed among those consumers and that no class of consumer shall be burdened unduly at the expense of some other class. In other words, now that this necessity of increased rates has come, we must look carefully and see that our rates are raised, and that the method of applying of those rates to the ultimate consumer are logical and beyond attack.

THE PRESIDENT:—Gentlemen, are there any others who wish to contribute to the discussion? If not, I will put to the meeting the question of the adoption of this report. (*Carried.*)

It appears that Mr. McDougall is obliged to leave before long. I should say, first of all, in reference to item 6,that that committee did not get to work early enough for a report to be ready and there is no report under the heading of "Report of Committee on Accounting." As to item No. 7; Mr. Wills Maclachlan is kind enough to defer his report until after that by Mr. George K. McDougall, who is obliged to go elsewhere. We will call Mr. McDougall.

MR. GEO. K. MCDOUGALL:—I would like to read a summary of the report of the Chairman of the Lighting Sales Bureau of the National Electric Light Association. I regret I was not able to get to any of the meetings of this Bureau. They were rather far away and I had not the time available.

SUMMARY OF THE REPORT OF THE CHAIRMAN, LIGHTING SALES BUREAU OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION

The full text of the Chairman's Report and those of the chairmen of the sub-committees presented at the convention in Pasadena, California, May 1920, can be obtained in printed form, Circular C5-20 of the Commercial Section.

The activities of the Lighting Sales Bureau for the past year have been along similar lines to those of other years, though somewhat experimental, as they were based upon a suggested organization made at the beginning of the year to determine upon a definite plan of procedure to be established for the future.

An attempt was made to have meetings held in the various geographic and company sections with speakers and lantern slides supplied by the Bureau, to which meetings representatives should be invited from kindred associations and others interested in the subject, who might participate in the meetings and bring up questions for discussion. This plan would have been an excellent one but was not taken advantage of except in one or two instances.

Another of the Bureau's anticipated activities was to establish an organization of a practical nature for central stations of different classes, with ways and means which might be employed locally to sell effectively the principles of good lighting. Unfortunately this plan was not carried out, but it is hoped that the incoming committee will consider this as an activity for its administration.

A co-operative movement was commenced to get closer co-operation between fixture manufacturers and the lighting companies. This met with success and as a result the lighting fixture people through their Association have asked for information which will assist in their designing and marketing fixtures that will produce efficient lighting without sacrificing artistic effects.

It is felt that this is the beginning of a movement which will be instrumental in decreasing the great variety of fixtures and units sold, which now seems unnecessarily large.

At a meeting of the Executive Committee in Chicago, a talk was presented which gave the results of an investigation made on factory lighting conditions. This talk was extremely instructive and interesting. It is suggested that material of this kind could be profitably used in inaugurating lighting campaigns.

The various divisions of the Bureau have prepared reports, some of which will be briefly referred to in the following paragraphs, while the others, being of a technical character are recommended as material for the Handbook to bring the Lighting Section up to date.

DIVISION ON COMMERCIAL ASPECTS OF LAMP EQUIPMENT

The correlation of data on the latest developments in lighting equipment has been made by this Division.

It is recommended that this section of the Handbook be made available to everyone in the lighting field so that it can be utilized to the fullest extent.

DIVISION ON STREET AND HIGHWAY LIGHTING

The report calls attention to the demand for adequate lighting of highways, especially by agencies outside of the industry. It refers to the decrease in percentage of accidents and gives data on recent investigations. Advantages of new methods of control and time switches are referred to.

DIVISION ON STORE LIGHTING

The committee's report is mostly Handbook material and covers suggestions for the lighting of small and large stores and show windows, and emphasizes the fact that proper lighting assists in the sale of goods. The use

of a lamp approximating daylight is recommended and some reference is made to the decorations in the store.

DIVISION ON LIGHTING OF LARGE BUILDINGS

The report of this division consists of Handbook material and covers sales, methods and data for better lighting, and consequently, increased load in large buildings.

DIVISION ON RESIDENCE LIGHTING

The report of the chairman of this Division is well worth reading by the layman as well as those connected with the installation and selling of house lighting. The separate rooms in a residence are covered and many suggestions are given which will show the possibilities of home lighting, as well as suggestions to assist in securing and expanding this class of business. It is hoped that next year's committee can arrange to conduct experiments and demonstrations which may be presented at the convention of the N.E.L.A.

DIVISION ON INDUSTRIAL LIGHTING

In order that the membership might better visualize the advantages to the central station from industrial lighting, the report of the Industrial Lighting Division took the form of a demonstration to show some of the elements to be understood by the lighting man so that he could apply them clearly to his work.

A wide spread appreciation of the advantages of good lighting in industrial establishments has been manifested by plant owners, which would indicate that in order to make campaigns successful in this class of installation the representative of the central station must be so equipped that he will receive recognition. This means that men capable of handling this question must be particularly trained, and it was with this thought in mind that the demonstration was arranged so that the possibilities might be shown more clearly to central station representatives.

PRESENT ORGANIZATION OF THE BUREAU AND RECOMMENDED CHANGES

The Chairman of the Lighting Sales Bureau recommends certain changes to the organization to overcome the difficulties at present encountered. These are due to the large organization and scattered membership making it difficult to get representative meetings. The recommendations are with a view to assisting the incoming members in overcoming the difficulties encountered in the present organization.

Respectfully submitted,

GEO. K. McDOUGALL,
Representative of C.E.A., on
Lighting Sales Bureau of N.E.L.A.

THE PRESIDENT:—I would suggest that you read your other report now if you like. This is "Report of Sub-Committee on Lamps".

A SUMMARY OF THE WORK OF THE ELECTRICAL SUB-COMMITTEE OF INCANDESCENT LAMPS OF THE CANADIAN ENGINEERING STANDARDS ASSOCIATION

As the representative of the Canadian Electrical Association on the above committee, I beg to make the following synopsis of the work undertaken by the committee:—

The Sub-Committee on Incandescent Lamps of the C.E.S.A. is composed of members representing various manufacturers, public utilities, Department of Trade and Commerce of Canada and the Canadian Electrical Association, under the chairmanship of Mr. John Murphy, Chief Electrical Engineer of the Department of Railways and Canals.

Up to the present, the committee's work has been carried on entirely through written discussion. Valuable assistance has been received from well-known gentlemen in the United States, who were connected with the "Standard Specifications for Incandescent Lamps" of the United States Bureau of Standards, Circular No. 13, U.S. Department of Commerce.

Circular No. 13 of the U.S. Bureau of Standards has been taken as a basis for discussion in the formulation of the proposed incandescent lamp specification for Canada, as it was considered to be the latest and most comprehensive document to work on.

Most of the discussion has centered around the question of the life and allowable percentage candle power reduction, or smashing point; the basis of comparison of lamps, as to whether it should be mean horizontal C.P. or lumens output; the selection and percentage number of lamps which should be tested, out of each lot, and whether the rating of series lamps should be in C.P. or Watts.

This committee has not yet held a meeting but one has been called for June 22nd, when all the written discussion will be fully gone over which should lead to some definite decision, as all the members of the committee have been enabled to study the written discussion.

In closing I am requested by the chairman of the Electrical Sub-Committee on Incandescent Lamps, to state that a discussion of the subject of standard lamp specifications for Canada, and the conclusions of this meeting of the Canadian Electrical Association in this regard would be of great value to the Canadian Engineering Standards Association in their work.

Respectfully submitted,

GEO. K. MCDOUGALL.

MR. MCDOUGALL:—I beg to move the adoption of these reports.

THE PRESIDENT:—Mr. Barnes seconds the adoption of the first report and Mr. Doddridge seconds the adoption of the second. These reports are both open for discussion if anyone wishes to contribute to discussion upon them. If there is no further discussion on this paper I will now call on Mr. Maclachlan to give the report of the Committee on Accident Prevention.

MR. WILLS MACLACHLAN:—Mr. Chairman and gentlemen, the following report is submitted by your committee composed of Mr. Heyward, of British Columbia; Mr. Kenyon, of Montreal; Mr. Lambert, of Ottawa; Mr. Martin,

of the Bell Telephone Company; Mr. McSweeney, of Niagara Falls; Mr. Neild, of Toronto; Mr. Vinet, of Montreal and Mr. Wurtele, of Montreal, and myself.

ACCIDENT PREVENTION REPORT

BY MR. W. MACLACHLAN, CHAIRMAN

A well-trained employee in doing some repair work brings his head in contact with a high tension bus and receives a shock and burns, which after a period of time result in his death. How many times have those of us who have to deal with the question of investigating serious and fatal accidents, found conditions somewhat similar to these? And this is only half of the story, because there is very often a widow and small kiddies left to fight life's battle alone. We are not presenting to you an entirely hypothetical case, but one which occurred within the past nine months and it is with the object of preventing such occurrences that accident prevention came into being and has developed to the proportion in which it exists today. Your committee has held various meetings during the past year and has drawn up for your consideration, a short report dealing with some of the more important facts that enter into the subject of the prevention of accidents and they will feel repaid, if, during the coming year the engineers, superintendents and executives take the report and apply it in as far as it pertains to their utility so that their employees will not be injured as in the past, leaving dependents inadequately provided for and also so that the company will be able to carry on its work efficiently and without the inexcusable waste of compensation payable for accident claims, which claims in the major part, by co-operation between management and employees, could be entirely done away with.

1. GUARDING OF HYDRAULIC EQUIPMENT IN POWER PLANTS

There has been considerable lack of information in regard to recommendations as to the prevention of accidents in hydraulic plants. A sub-committee of men who have been for years conversant with the operation of large hydraulic plants, was appointed and in detail report No. 1, will be found several recommendations which have been presented to the committee, receiving their endorsation and support.

2. GUARDING OF HIGH-TENSION APPARATUS

Although in the electrical utility the greatest number of accidents are not caused by electrical current, yet the greatest amount of lost time and the cost of the accidents are most certainly due to this cause. With this thought in mind, a report has been prepared on some of the more important points in connection with the guarding of high-tension apparatus with the hope that superintendents and designing engineers will read the report and that it may suggest to them a line of action that should be taken, either in the design of a new property or in the reconstruction or guarding of an old property. Purposely, the report has only touched the high spots and a particular endeavour has been made to keep away from detail, as volumes have been written in the past on this subject and we think it has been found that when

an endeavour is made to go into a subject in detail, the question becomes so involved that only very complete and careful study of the material makes it of value in practical application. Detail Report No. 2, is attached.

3. REPORT OF N.E.L.A. COMMITTEE ON ACCIDENT PREVENTION

We would draw to your attention the report of the Committee on Accident Prevention of the National Electric Light Association, in the preparation of which report, members of your committee have been of some assistance. This report contains among other things, detail information in connection with the apparatus used in the testing of rubber gloves and anyone who is not entirely familiar with this question would do well to read carefully the Report of the N.E.L.A. Committee in this regard.

There will also be found in the report, Fundamental Rules for Accident Prevention, which have been extremely carefully prepared with a view to supplying a short set of concise rules which could be put into effect in a company with very little modification. The need for such a set has been felt for sometime and hence its preparation. The question of resuscitation has been gone into and a number of typical cases are presented, pointing out where the method was properly applied and where a life might have been saved if other things had been done.

The question of grounding is drawn to the attention of the members and a very complete index to the requirements of the National Electrical Safety Code on the question has been prepared and is presented. For engineers who are studying the question of grounding, it would be well for them to obtain a copy of this index as it would be of very material assistance to them in studying. Other matters dealt with in the report are: The Lack of Illumination around Public Utility Plants, Changing of Insulators on High Tension Lines while alive, Testing of High Tension Lines, Buses etc., Placement of Name Plates, etc.

This report of the National Electric Light Association Committee has been prepared after a number of Committee meetings and has been very carefully gone into and we would recommend the study of it by anyone having to deal with apparatus or employees in a public utility.

4. LINEMEN'S SAFETY BELT

Your committee in co-operation with the N.E.L.A. Committee has, for the last few years, been studying the question of a standard specification for linemen's belt and presents for your discussion and with the hope of your approval and endorsation, a specification for a lineman's belt. Samples of this belt have been in use by various line gangs for something over a year and are found to be very satisfactory, and although possibly meeting opposition in the first case from linemen, yet after they have used the belt for sometime they have uniformly endorsed it. These specifications are to be found in Detail Report No. 3.

5. REPORT OF ACCIDENTS

A few months ago, the secretary of the Association sent out to Class "A" members, a letter asking that accidents be reported and supplying report

forms. Up to June 1st, six member companies in the province of Ontario have sent in reports of accidents to employees. We would ask the co-operation of the other member companies to see that these reports are sent in so that they can be analysed and information supplied to you as to the type of accidents which are occurring and the remedies that would be recommended. It is only by mutual co-operation that this work can be carried on successfully.

6. HEALTH PROMOTION AND ACCIDENT PREVENTION

One of the reasons for the carrying on of work in accident prevention is to cut absenteeism among employees to a minimum and in that way carry on the activities of the utility in an efficient manner. It would be well for us, we think, to possibly look into the question of the relative lost time due to sickness and due to accidents. There is very little available data to carry on the analysis but your committee has had before it accurate data from one very large public utility. During the year 1918, employees of this utility lost on the average 7.2 days each on account of sickness, during 1919, they lost 6.4 days each on account of sickness. In one department having to do with construction maintenance and repair of overhead lines and inside equipment, during 1919, they lost 2.7 days each on account of sickness and but 1.9 days each on account of accident. This department due to the fact that their men are for the most part outside and also due to the fact that the work that they are doing necessitates good physique, they have lost a comparatively small number of days on account of sickness, but this department is more subject to the hazard of the industry than any other department. So we find that in the department in which the hazard of the industry is greatest, accidents caused a loss of approximately 2 days per man per year and yet in the whole industry there is a loss due to sickness of approximately 6.5 days per man per year. We do not wish to belittle the question of the prevention of accidents, but statistics can be shown that by active co-operation in accident prevention, lost time in a utility has been reduced in two years from two days per man per year, to .65 days per man per year. If this is possible in accident prevention, would it not also be possible by co-operation and by education, correct sanitary arrangements and physical examination, to very considerably lower the lost time due to sickness and also at the same time increase the efficiency of the employees while they are at their work.

We would recommend most strongly that executives take this matter into very serious consideration as it is most certainly one that will increase the efficiency of the whole working staff.

7. DEVELOPMENT OF CO-OPERATION

In the present days of unquestionable unrest, there are many cures being presented and those interested in the work are possibly very doubtful as to the effectiveness of a number of these so-called cures. For a number of years, accident prevention has been successfully carried out by committees of employees and the management discussing the problems and arriving at a mutual agreement as to the best way to solve them. These committees have

been so universally successful that it is possibly not without good reason that those who have been actively working with the committees, see in them a possible solution of at least some of the problems that are before us. Some large employers, more particularly in the manufacturing part of the industry have put committees into being, upon which the management and the employees are equally represented and all questions pertaining to wages, hours of work and working conditions are subjects for discussion by these committees. As soon as a policy is decided upon, the execution of that policy rests with the management, but it can be made a subject of discussion by the committee at any time. Very little has been done in the public utility along these lines, although there are some very notable exceptions and one or two of these exist in Canada.

We would strongly recommend that the question be thoroughly studied by future committees and that they be given authority for that study by the Association, and we would further recommend to any executive a careful study and investigation of plans for employee representation as a possible means of solving the difficulties that have arisen between employee and management.

"He has achieved success who has lived well, laughed often and loved much.

"Who has gained the respect of intelligent men and the love of little children. Who has filled his niche and accomplished his task. Who has left the world better than he found it, whether by an improved poppy, a perfect poem or a rescued soul. Who did not lack appreciation of earth's beauties nor fail to express it. Who looked for the best there was in others and gave the best he had. Whose life was an inspiration and whose memory is a benediction."

DETAIL REPORT NO. 1

GUARDING OF HYDRAULIC EQUIPMENT IN POWER PLANTS.

FOR OUTSIDE HYDRAULIC WORK

1. Good lighting is very important, and an auxiliary means of lighting should be provided in case of failure of the electric system through trouble.

2. Life bouys and ropes should be placed so as to afford a ready means of helping anyone falling in canal or intake.

3. Men working in proximity to racks should always wear life lines, whether for working on the surface of the water or under the surface with diving suits.

4. Wide platforms should be provided at the racks to give plenty of room for workmen to use their rakes when cleaning the racks. Angles or projections of some sort should be placed near the edge of platforms over racks so as to prevent slipping.

5. A supply of sand and ashes should be handy at plants for use under foot in slippery weather.

6. Hand lines should be attached to tools so that if one is dropped the workman would not grab for it and possibly overbalance himself.

7. Steel grips or spurs to be strapped on soles of shoes or rubber boots to prevent slipping, especially when the ice is wet.

8. Hand rails should be provided where practicable.

9. More than one man to be sent to do the work.

FOR INSIDE HYDRAULIC WORK

1. Good lighting and an auxiliary means of lighting should be provided in case of failure of the electric system through trouble.

2. In cases where air pipes are placed in gate-houses, or in such places as to be accessible to the men, when a covering is placed over these air pipes it should be fastened to the floor so that any sudden rush of air would not cause anyone to be thrown away or hit by rack.

3. In power plants where turbines are located low down on floors, means of exit should be provided so that should the place be flooded suddenly the men may have a chance of escape.

4. Workmen engaged in repairs to the interior of the penstocks or wheel casings, should be provided with life lines, platforms or ladders in order to insure them against accident due to the slippery surface.

5. Guard rails should be provided at edges of platforms and pits in power houses to guard against the possibility of falls.

6. All moving parts of machinery, such as gears, belts, speed regulating balls, etc., should be well protected by means of screens or guards so as to prevent anyone coming in contact with same.

GENERAL

Each hydraulic plant is an individual study of its own, but all general rules for safety should be strictly enforced in every plant, and, "No Admittance" signs should be conspicuously placed at all entrances and all places of danger.

DETAIL REPORT NO. 2

GUARDING OF HIGH-TENSION APPARATUS

The arrangements for the guarding of high-tension apparatus should start with the preliminary design of any high-tension installation. Adequate space for operation, maintenance and repair of high-tension apparatus, is one of the first essentials in guarding this apparatus. Along with adequate working space should go sufficient illumination for all necessary work. It is not always possible to start with the design as the necessity for the guarding of apparatus has been given a more prominent place, more particularly

in the last five years. With this thought in mind the following points might be well taken into consideration:

1. GENERAL

(1) GROUNDS:—There should be a particularly good ground arranged for at the station. This ground should be regularly and systematically tested to see that it and its connections are in good condition. To this ground, all the metal frame-work of the station should be connected by conductors of adequate capacity to take care of any ground current liable to pass over them.

(2) NAMES OF SWITCHES:—Each switch, whether disconnecting or oil should have placed on it or near it, its name, in such a way that it can readily and easily be read from the position in which the operator will stand to operate the switch. Names should also be placed on switch tanks, if the name of the switch near the operating mechanisms, is not clearly and distinctly visible from the switch tank.

(3) SEPARATION OF SWITCHES:—Switches that are in banks, should have some distinctive mark between the switches. Such a mark might take the form of a coloured baffle board or a strip of paint on the bus structure between the switches. Some companies in placing the bafflle board, place the number or name of the switch on the side of the baffle board toward the switch.

(4) DISTANCE BETWEEN CIRCUITS:—Adequate distance should be supplied between circuits so that any maintenance or repair work can be done on one circuit without endangering the operator by the circuit adjacent to it. In old installations where it is found that this distance does not exist, insulating temporary baffle boards or guards should be supplied to the maintenance and repair gang.

(5) EXITS:—Arrangements should be made for two exits from behind all high tension switch structures, switchboards, switch galleries or lightning arrester galleries. One of these may be an emergency exit.

2. OIL SWITCHES

(1) The metal cases and metal parts not in electrical circuit should be permanently grounded.

(2) Oil switches in bus structures should be supplied with doors, preferably made of asbestos board in a light wooden frame.

(3) The movable parts of the operating mechanism of the oil switch should receive attention and where necessary, guarded. This particularly refers to fuarding all small toggle parts.

(4) Oil switches should have in the circuit on each side of them, disconnecting switches.

(5) Means should be provided, for locking oil switch in the open position.

3. DISCONNECTING SWITCHES

(1) Provision should be made for guarding the terminal of a disconnecting switch where it is necessary to work on the blade and have the terminal alive.

(2) Disconnecting switches, the phases of which are placed close together should be equipped with baffle boards between the phases.

Note:—This may cost considerable money in old installations, but the protection against a dead short circuit well warrants the expense.

(3) Ample working space should be provided for the operator when handling disconnecting switches. Particular note should be made of what is immediately behind the operator when he is opening or closing disconnecting switches.

(4) Care should be taken to clearly differentiate between disconnecting switches and sectionalizing switches. Many accidents have occurred due to trying to combine the functions of these two switches in one switch.

4. Meter Transformers

(1) Name plates on meter transformers, should be arranged to be easily readable from a safe position.

(2) Test links of meter transformers should be arranged for on the front of the board.

(3) It would be well to take into consideration the advisability of placing disconnecting switches between current transformer and bus bar.

(4) In the case of large current transformer, special protection should be arranged for the spark gap.

5. Transformers

(1) Cases on transformers should be permanently grounded.

(2) Thermometers on large transformers should be arranged so that they can be read from the ground.

(3) Disconnecting switches should be arranged on each side of the transformer.

6. Lightning Arresters

(1) Metal cases for lightning arresters should be grounded.

(2) In lightning arresters of an ungrounded type, screens permanently grounded should be arranged around tanks.

(3) Disconnecting switches should be placed in each lightning arrester circuit.

(4) In installing the smaller type of lightning arrester, arrangements must be made so that the lightning arresters are readily accessible.

(5) In the outdoor type, the operators platform should be guarded on three sides and top by screen.

Note:—This to protect the operator from flying porcelain should an insulator break; not an extremely unusual thing.

7. Auxiliary Equipment

(1) Switch Sticks and Tongs:—Switch sticks and tongs should be carefully chosen in the first place and be of good, insulating material. A regular place should be provided for keeping them and they should not be hung on an outside wall nor closer than 3 inches to any wall. This is to protect against moisture depositing on the surface.

(2) FIRE-FIGHTING APPARATUS:—A clear distinction should be made between apparatus that can be used on live parts and apparatus that cannot be used on live parts. In other words, any apparatus using carbon-dioxide as an extinguisher should be marked "Do not use on live apparatus."

(3) TEMPORARY GROUNDING APPARATUS:—Special arrangements should be made so that temporary grounding apparatus is supplied in each station. In the larger stations means should also be supplied for testing this grounding apparatus to see that it is in good condition.

(4) RUBBER MATS, ETC.:—Rubber mats and insulating wooden grids should be supplied where necessary around switchboards. It will be found that a rubber mat in front of a long switchboard will particularly assist the operator in fast operation in time of emergency.

(5) TELEPHONE EQUIPMENT:—Arrangements should be made for suitably protecting the operator when using the telephone, particularly if the telephone circuit is paralleling the high-tension lines.

(6) Auxiliary lighting should be supplied around all high-tension apparatus.

(7) DANGER SIGNS:—Carefully chosen danger signs, intelligently placed will be of particular value in preventing accidents. These should not be promiscuously used, but should be placed where there is a real hazard.

An endeavour has been made in the foregoing to touch some of the high spots in the guarding of high-tension apparatus and possibly to direct a line of thought to the operating superintendent or engineer in charge of design so that he may by following out this line, protect the apparatus coming under his charge so that those coming in contact with the apparatus will not be injured.

DETAIL REPORT No. 3

SPECIFICATIONS FOR THE PURCHASE OF LINEMEN'S LEATHER BELTS

GENERAL

The materials used in the manufacture of these belts shall be of the best obtainable of the grades specified, and the workmanship shall be of the best. Fig. 14 forms a part of, and supplements these specifications.

DEFINITIONS

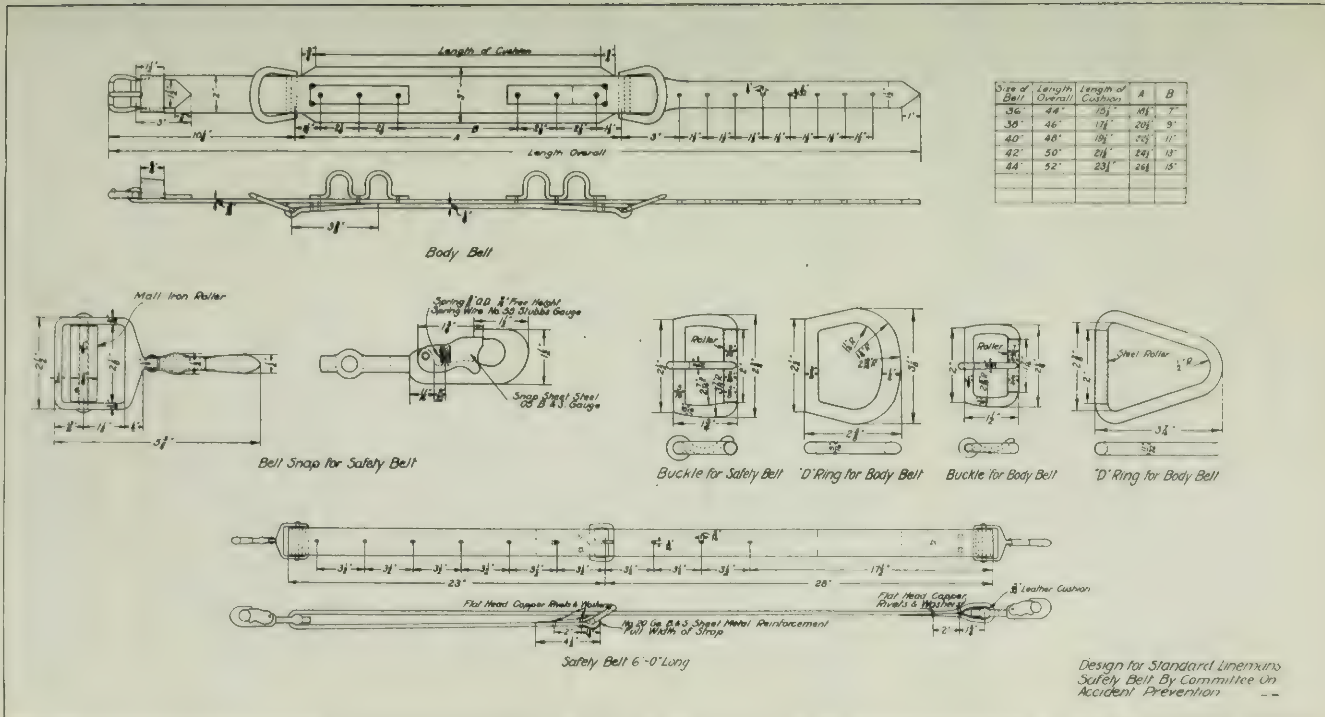
A lineman's belt shall consist of two members, (*a*) a body belt and (*b*) safety belt.

The body belt shall consist of the following parts:—(*a*) cushion, (*b*) strap, (*c*) tool strap, (*d*) strap-keeper, (*e*) buckle, (*f*) "D" rings, (*g*) rivets.

The safety belt shall consist of the following parts:—(*a*) strap, (*b*) reinforcements, (*c*) snaps, (*d*) buckle, (*e*) rivets.

The general arrangements of these parts shall be as shown in the accompanying drawing.

The length of the body belt shall be taken as from the extreme end of the buckle to the middle hole at the other end of the belt.



Size of Belt	Length Overall	Length of Cushion	A	B
36"	44"	15½"	18½"	7"
38"	46"	17½"	20½"	9"
40"	48"	19½"	22½"	11"
42"	50"	21½"	24½"	13"
44"	52"	23½"	26½	15"

(Fig. 14)

INSPECTION

At the option of the purchaser an inspector shall be permitted to be present during the manufacture of the belts and shall be given every opportunity to assure himself that the belts are made in accordance with these specifications.

Acceptance by the inspector of any material or method of manufacture shall not, however, relieve the manufacturer from the obligations of these specifications.

TESTS

All belts shall comply with the following tests:—

Immediately after manufacture, the completed belt shall successfully withstand a tension of 1,000 pounds gradually applied between body and safety belt for one minute.

REJECTION

Belts made up of inferior materials, or not made in strict accordance with these specifications, or not meeting the tests prescribed in these specifications, will be rejected.

MATERIALS

All leather used shall be of the best grade oak tanned and black finish, cut from the back of the hide only, with the exception of that used for tool straps, loops and protecting pads, which may be cut from other parts of the hide providing the leather is of good quality and of the thickness required. All cut edges shall be rounded off.

The "D" rings shall be made of malleable iron or drop forged steel galvanized or japanned, and of the dimensions shown in the drawing or of equal circular cross-section.

The buckle shall be made of steel, galvanized or japanned and be of the dimensions shown in the drawing.

The snaps shall be made of malleable iron or drop forged steel, with the exception of the guard of the snap-hook, which may be of stamped steel, and all parts with the exception of the rollers, shall be galvanized or japanned.

All rivets shall be of copper of 1-8 inch diameter with copper washers on each rivet.

The twine used for stitching shall be of the best quality linen.

BODY BELT:—The body belt shall be not less than two inches wide from end to end and not less than 3-16 inch thick.

The cushion which is secured to the inside and made a part of the body belt, shall be 3 inches wide and 1/4 inch thick tapered to a minimum of 2 inches to take the "D" rings.

The tool straps shall be not less than 1 inch wide and 3-16 inch thick.

The lengths for the different size body belts shall be as shown in the drawings.

The holes in the body belt shall be punched as shown in the drawing and shall be elliptical, not over 1/4 inch long, punched lengthwise with the belt.

The strap-keeper on the body belt shall be not less than 1 inch wide and 1-8 inch thick.

The buckle on the body belt shall have a cross-section diameter not less than 1/4 inch in any part, with the exception of the tongue, which shall be 5-32 inch diameter.

SAFETY BELT:—The safety belt shall be not less than 2 inches wide and 1/4 inch thick and shall be 6 feet in length, measured from the shaft of the outboard snap to the extreme end of the buckle.

The holes in the safety belt shall be punched as shown in the drawing and shall be elliptical, not over 5-16 inch long, punched lengthwise with the belt.

The reinforcement at the snap hook shall be of leather or No. 20 B. & S. sheet metal 2 inches wide, riveted as shown.

The buckle on the safety belt shall have a cross-section diameter not less than 5-16 inch thick in any part.

ASSEMBLY

All parts of the belts requiring stitching shall be double sewed. Stitching parallel to the edge shall be not less than 1/4 inch and not over 3-8 inch from the edge of the narrowest member caught by the twine.

BODY BELT:—Before attaching the cushion to the body belt, the eye forming supports for the "D" hooks shall be made by tapering the cushion at each end forming a lap extending back between the cushion at least 4 inches. These laps shall then be sewn down each edge.

The belt and cushion shall then be sewn together along both edges, resulting in double stitching at the laps.

The tool strap will be riveted in, making the cushion belt and tool strap triple riveted at each end, the first rivet from each end securing two thicknesses of cushion forming the lap for the "D" ring eye, one thickness of belt and one thickness of tool strap.

The buckle eye-lap shall extend back 3 inches with a 1 inch taper on the outside of the belt and shall be sewn along the straight edge and around the taper, the strap-keeper being sewn in at the same time.

SAFETY BELT:—One snap shall be laid in the loop of the belt while assembling.

The eyes forming the supports for the other snap-hook and for the buckle shall be made by tapering the belt at each end and forming a lap on the inside of the belt extending back a sufficient distance to permit of stitching the lap to the belt for a distance of 4 inches. After stitching the lap, the metal or leather reinforcing piece at the snap hook, shall be placed in position and riveted.

The laps shall be triple riveted. One of these rivets shall pass through the lap and belt near the end of the taper, as shown and the other two rivets will be used to secure the reinforcement which will be looped about the eye of the belt, the rivets passing through the lap and the reinforcement close to the eyes for the buckle and snap hook as shown.

THE PRESIDENT:—Gentlemen, I feel we are greatly indebted to Mr. Maclachlan and his committee for that very interesting report which he has presented, certainly not rendered the less delightful by that beautiful quotation he gave at the end.

MR. MACLACHLAN:—I move the adoption of the report.

MR. KENYON:—I second the report.

THE PRESIDENT:—Is there anything you wish to say in connection with it? I suppose we are all very much in agreement with the committee's recommendations and committee's remarks generally.

I may say, gentlemen, that Mr. Beaumont has now an interesting announcement to make us in reference to this evening's somewhat serious proceedings.

MR. BEAUMONT:—At 7 o'clock there will be a dinner, and tickets can be had at the door. During the dinner an entertainment will be provided and I expect it will last probably till 9 o'clock or longer.

After dinner the members, accompanied by ladies, will adjourn either to the Green Room for bridge or, if they wish to dance, to the Venetian Gardens. Tickets for admission to the Venetian Gardens will be obtained from Mr. Elliott at the door, for which there is no charge, and members unaccompanied by ladies will adjourn to the Grill Room for the Monte Carlo tonight, which will commence practically 20 minutes after the dinner.

THE PRESIDENT:—The next item on the programme is report from Mr. Neild--two reports from him—both of which will now be read by Mr. Volkmann in the absence of Mr. Neild. The first will be Report of Representative on the N.E.L.A. Committee, "Electrical Apparatus Committee N.E.L.A."

THE SECRETARY:—I am not going to take very much of your time by reading these reports, as they are a page each.

REPORT OF REPRESENTATIVE ON ELECTRICAL APPARATUS COMMITTEE OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION

Mr. President and Fellow-members:—

I herewith beg to report that your representative attended executive sessions of this committee.

Many of the findings are included in the report of the Canadian Electrical Association, Electrical Apparatus Committee, but I would particularly draw your attention to the part relating to an effort to obtain definite data on oil circuit breaker operation.

I also wish to draw to the attention of the members that all the information and data of the National Electric Light Association Electrical Apparatus Committee is at their disposal, and their representative can obtain for them a great deal of information if so desired.

In closing I wish to express my appreciation of the warm fellowship extended to me on my visits to the National Electric Light Association, committee meetings.

Respectfully submitted,

J. F. NEILD.

MR. VOLKMANN:—And I might as well read his report as our representative on the Transformer Sub-Committee of the Canadian Engineering Standards Association.

REPORT OF REPRESENTATIVE ON TRANSFORMER SUB-COMMITTEE CANADIAN ENGINEERING STANDARDS ASSOCIATION

Mr. President and Fellow-members:—

As your representative on the Canadian Engineering Standards Association Sub-Committee on Transformers I herewith beg to report that executive sessions were held of the sub-committee composed of operators and manufacturers and a report adopted dealing with the standards of design of Distribution Transformers.

This report has been forwarded the the Central Committee of ratification and in due time will be published. Every member of the company will obtain copies of this report when published.

Your representative would suggest that the members should give some thought to the standardization of station transformers, as the question may possibly come up in the future.

Respectfully submitted,

J. F. NEILD.

MR. VOLKMANN:—I move the adoption of both these reports.

MR. M. C. GILMAN:—I second it.

THE PRESIDENT:—These reports are before you and if there is any discussion upon them I would like to hear it. If there is no discussion, I will put it to the meeting that these reports be adopted. (*Carried.*)

In the absence of Mr. Ackerman, Mr. Volkmann will read the report of Mr. Ackerman on "Inductive Interference" Committee, N.E.L.A.

THE SECRETARY:—I had hoped that we would have Mr. Ackerman with us today himself, but he sent me a letter this morning that he would be out of town.

REPORT OF REPRESENTATIVE ON INDUCTIVE INTERFERENCE COMMITTEE OF N. E. L. A.

JUNE 14, 1920.

THE PRESIDENT,
Canadian Electrical Association,
Montreal, Que.

Dear Sir:—

As representative of the Canadian Electrical Association on the Inductive Interference Committee of the N.E.L.A., I wish to report herewith to the Association regarding the activities of the committee for the past year.

I enclose herewith printed report of the committee as presented to the Convention of the N.E.L.A., at Pasadena, which gives a detailed summary of

the work done for the past year. There is little to be added to this report.

The writer was unable to attend any of the three committee meetings, but has been in constant touch with the committee and has given such assistance and information as affected the territory of our Association.

The Inductive Interference Committee was formed last year as Sub-Committee of the Technical and Hydro-Electric section of the N.E.L.A., particularly in view of serious legal controversies that had arisen in different parts of the country between telephone and power interests, in which it was felt that the power interests were not sufficiently familiar with the problem involved to protect their interests. The committee endeavours to collect such technical and legal data in order to be of assistance ot member companies in need of advice. It also tries to pave the way for mutual co-operation between the two interested parties.

Fortunately, no such legal controversies seem to be known within our territory, as apparently the proper spirit of friendly co-operation between the power and telephone and telegraph interests seems to exist.

The technical problem of inductive interference, however, seems to be present in our territory as elsewhere, and the benefit to be derived from the committee work should, therefore, also prove useful to our Association.

I wish to take advantage of this opportunity to appeal to the member companies which have not yet returned the questionnaire to do so at the earliest moment possible, whether they have, or have not anything to report. We would also be thankful if the member companies would assist the work of the representative by answering promptly any communications they may receive from time to time.

Yours very truly,
P. ACKERMAN.

THE SECRETARY:—I move the adoption of the report.

MR. MCDUNNOUGH:—I second the adoption.

THE PRESIDENT:—Now, gentlemen, perhaps there are some of you wish to discuss this paper on "Inductive Interference," if not, I will put it to the meeting. Those in favor of the adoption of the report? (*Carried.*)

The next item, Mr. Kenyon will favour us with the Report of the N.E.L.A. dealing with underground systems.

REPORT OF THE UNDERGROUND SYSTEMS REPRESENTATIVE ON N. E. L. A. COMMITTEE

This report endeavours to point out only what the writer thinks to be the more important items brought under discussion and the conclusions arrived at.

During the past year, three meetings were held as follows:—

October 1st, 1919, Cleveland; December 17th, 1919, Chicago; February 16th to 18th, 1920, New York.

The question of 3 conductor vs. single conductor cable was gone into and the conclusion reached that for voltages up to 25,000 volts, 3 conductor cable was more economical. For voltages higher than 25,000 volts and for capacities larger than 10,000 K.V.A., each problem should be worked out separately, when the use of single conductor cable would probably be found more economical.

The question of safe operating temperature of cables was discussed and very little reliable information was disclosed, and it is recommended that investigation be put in hand with a view of determining the safe limit of heating of paper cables, and that a fund should be created to bear the expense of special research work in this connection. In this connection, it is pointed out that the dielectric loss of the paper insulation using vegetable compound or combined mineral and vegetable compound is higher than when a mineral base compound is used. This question is further complicated by the fact that deilectric loss depends not only on the materials used but on the amount of drying out which the insulated cable receives before the lead sheathing is installed. There is also the difficulty of standardizing the method of measuring dielectric losses and making commercial tests to determine these losses at a moderate cost. In a general way it may be said that the safe operating temperature will be:—

"A"—The temperature at which the insulation next to the conductor will rapidly deteriorate.

"B"—The critical temperature at which the dielectric losses together with the copper losses have an accumulating effect.

The material for ducts and method of installing them was discussed and it was the consensus of opinion that reliance should not be placed on the material of which the duct was composed for preventing the arc from the burnt out cable damaging a cable in an adjacent duct and that a spacing of 1-inch concrete should be placed between the conduit. Failures of this kind reported show that in nearly every case, tile conduit was used without the concrete spacing, and that no failures were recorded where fibre conduit was used with concrete in between the ducts. It was recommended that ducts when entering a manhole should fan out vertically and horizontally so as to give larger spacing between the cables to allow for protecting them against arcing of adjacent cables. The material to be used for ducts was recommended in the following order:—

1. Concrete ducts.
2. Fibre ducts.
3. Single duct vitrified tile.
4. Multiple duct vitrified tile.
5. Iron pipe.

It was recommended that the lead sheathing of all cables be well bonded in each manhole and that all ducts be sealed to prevent escape of gases and consequent danger of explosion and burning of same.

The question of fire-proof protection of cables in manholes was taken up and it was stated that a concrete covering well laid forms the best arc resisting material, and should be at least ½ inch thick. The writer, however, would like to point out that there is difficulty experienced in properly placing the concrete protection over cables in manholes due to experienced labor being required and great care exercised in putting on the concrete. The writer has always used asbestos webbing coated with water-glass and has found same very satisfactory. This webbing is very easily removed for inspection purposes and for change in method of racking cables in manholes, bonding, etc.

The method of locating faults in cables was taken up and it was found that the method used by different companies varied, not only by the companies themselves but on account of operating voltages, connected generator capacity, current limiting devices, relay and time-setting schemes. It was found that there were two principal methods used, one the so-called loop test and the other the inductive method. In making tests it has been found necessary to have a low resistance fault and if such does not exist, it is necessary to have a path across the fault of low resistance by breaking down with high voltage if necessary. The most common types of instruments used for loop tests are: Leeds & Northrup, Fisher Test Set and Westinghouse Cable Localizer.

In using the inductive method, a signal current is impressed upon the faulty conductor, and an exploring coil is used in the different manholes with a view of determining between which manholes the fault exists. Among the inductive types of fault locators are: The Lundin Fault Locator and Matthews Telefault.

Attention was drawn to the use of a megger in making preliminary tests, which in many cases will show the type of fault, and in some cases where conductors are burnt in two and branch cables are used, the locality of the burn out will be localized within certain limits. The writer wishes to point out that with any fault finding apparatus, a man of suitable experience in testing and reducing test results to show actual conditions as an operator is necessary. It is also to be noted that the old method of opening manholes and oloking and smelling for signs of burn-out is still responsible for the locating of a majority of faults. This is, of course, particularly true when the majority of cable faults experienced are in the joints or at or near the edge of the ducts. With all fault locating apparatus, it is sometimes necessary to use a fault resistance reducer usually consisting of a motor generator set with transformer having various taps so that the voltage impressed on cable can be

varied up to perhaps higher than the ordinary operating voltage. This apparatus can, of course, be used for testing cable newly installed under guarantee and for building up voltage on repaired cable to prevent the possibility of a short-circuit, when any doubt at all as to insulating qualities of cable may exist, and a most desired quality for fault reducing apparatus is a device for limiting the current should the resistance of the fault suddenly drop.

A record of high tension failures has been complied and although this record has not been kept a sufficient length of time to be of great value, it is hoped that by continuing same from year to year, very valuable data will be obtained.

A specification for P.I.L.C. cables was prepared in conjunction with the Transmission and Distribution Committee of the A.I.E.E. in conference with nine cable manufacturers. The writer begs to recommend that these specifications be printed and sent to the various cable manufacturers in Canada with a view of having them changed or adopted as a standard.

Respectfully submitted,

L. A. KENYON.

MR. KENYON:—I move the adoption of the report.

MR. PRATT:—I second its adoption.

THE PRESIDENT:—Is there any discussion upon this quite interesting paper? Well, gentlemen, if there is no one who wishes to discuss it I will put the motion before the meeting. Is it your pleasure that the motion be adopted? (*Carried.*)

So far as I am aware that finishes the business for the afternoon. You have already heard the announcement of the matters going forward this evening, which begin at 7 p.m.

The programme tomorrow will largely consist,—and we are very happy in thinking it will be so,—of addresses from our good friend, Mr. Lincoln, and fromMr. Martin J. Insull, who we expect will arrive very shortly. I hope tomorrow we shall be here in even greater numbers than today.

Meeting adjourns at 5 p.m.

MORNING SESSION

JUNE 17TH, 1920.

THE PRESIDENT:—Yesterday we had the pleasure of welcoming Mr. Lincoln and he was kind enough to contribute very materially to our discussion. This morning we are going to have the pleasure of listening to him. I might also say that we have here and had the honour and pleasure of welcoming him last night, Mr. Martin J. Insull, tbe President of the National Electric Light Association. I am not alluding to him more prominently just now, because in a sense he is incog. this morning, having business to do which may make it necessary for him to be elsewhere and it may be more convenient at present to treat his presence in an informal way and this afternoon to welcome him officially.

I have great pleasure in calling on Mr. Lincoln to give us his paper on "Metering the Customer's Load".

I must apologize to you and the speaker but I have been-waiting for Mr. Dunlop, our Vice-President, to arrive. In a matter of this kind, involving a lot of technical interest, it seems to me proper that some one better versed than I should occupy the Chair. I will, therefore, call on Mr. Dunlop—at the same time remarking to you all that it is hoped by the speaker, as well as by ourselves, that after this paper we shall have discussion on the points by all who are interested in the matter. I will ask Mr. Dunlop to kindly take the Chair.

Mr. E. A. Dunlop, First Vice-President, takes the Chair.

THE CHAIRMAN:—Just one moment, I would like to correct an impression which perhaps Mr. Grier left with you, that I am technically equipped or trained. However, I shall be very glad to do what I can to preserve order.

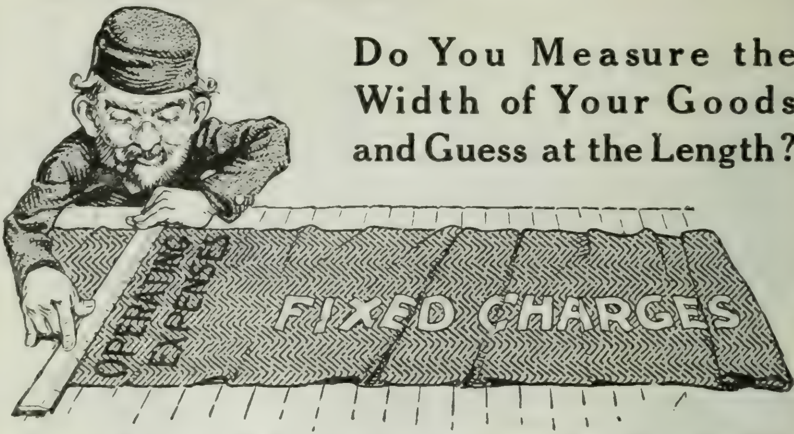
METERING THE CONSUMER'S LOAD

BY PAUL M. LINCOLN (Lincoln Electric Co., Cleveland, Ohio)

It is a trite saying that the luxuries of yesterday become the necessities of to-day. This saying is true of nothing more thoroughly than of electric service. The first commercial use for electricity was for arc lighting and the first commercial arc lamp was put into operation less than 45 years ago; the incandescent lamp is scarcely 40 years old. While electric power service was used to a limited extent during the late eighties and early nineties of last century, such service in the modern sense may truly be said to have begun with the inception of the Niagara Falls Power Company which began commercial operation during the Summer of 1895, or less than 25 years ago. Within my own lifetime, therefore—in fact, within a space of time but little longer than my professional career—electric service has become transmuted from a luxury into a necessity. Power is as essential to modern industry as is the blood to a man, and the electrical method of generating, transmitting and distributing such power has so many advantages over other methods that it is fast superseding all other methods; in fact, industry has come to be so dependent on electric power that it would become well nigh helpless without it.

Further, the business of furnishing power to our modern industries has come to be recognized as one distinct and apart from the industry itself. Power can be more cheaply and efficiently generated, transmitted and distributed in large quantities than in small. Hence, few modern industries can afford to manufacture their own power when central station power is available. As a result, the tendency in the past has been and undoubtedly will continue to be toward the elimination of the isolated plant and the extension of central station service. In my own mind there is no doubt but that this is logical and is justified by the fundamental consideration noted above, viz.; that power can be generated, transmitted and distributed more economically in large volume than in small.

Do You Measure the Width of Your Goods and Guess at the Length?



The cost of the service you give to customers is made up of two items

FIRST—OPERATING EXPENSE.

This depends to a great extent on the amount of current consumed by the customer, and you measure this carefully with an accurate instrument.

SECOND—FIXED CHARGES.

This is by far the largest item of cost and it remains the same whether you happen to sell a thousand Kilowatt hours, or a millon, a month. It depends on the customer's maximum demand and this you *guess at,* though it is more important than the power used.

Isn't that like measuring the width of your goods and guessing at the length?

The Lincoln Demand Meter tells you the maximum demand of any consumer every time his meter is read. It gives you a fair basis for billing his service. It makes him pay his just share of your fixed expense.

In other words, you are absolutely certain to get a profit from every customer instead of making some power-users pay for what others use.

The Lincoln Meter will be appreciated by power consumers. It will satisfy them and pay you because it is the one right way to measure service.

Hand now on left varies with load and shows it at any time of day.

Hand now on right moves only to right and indicates maximum load since last resetting.

Lincoln Meter Co., Limited

243 College Street, Toronto, Canada.

Cable, "Meters" Toronto Phone, College 1374

Lincoln MAXIMUM DEMAND meter

The specialization of the business of generating, transmitting and distributing electric service brings with it, of course, the problem of rates for the sale of such service and this in turn entails the problem that I have made the subject of this paper, "Metering the Consumer's Load." It might be well first to review briefly the question of rates for electric service from an historical viewpoint.

The first commercial use of electric service was for arc lamps and these have almost invariably been restricted to street illumination. From the beginning, when arc lighting service has been rendered, it has been customary to base the rate upon the lamp-year as a unit. This basis has proved entirely satisfactory for this specific kind of service; incidentally also, the rate usually includes the upkeep of the lamps and other equipment necessary to render the service. In this case, it is not electric service that is bought and sold so much as it is a certain unit of light and usually for a certain specific duty. When bought and sold on a basis of light, rates for the electric service used in arc lighting becomes a relatively simple matter, and if all electric service were restricted to arc lighting, there would be no "rate problem." With the introduction of the incandescent lamp during the early eighties of last century the problem of rates for electric service became somewhat more complex. At first, the methods of selling service for incandescent lamps were the same as for arc lamps, that is the so called "flat rate" or a certain fixed amount for each lamp per month. Soon, however, it was recognized that it was illogical not to consider the length of time during which the lamps were burned and the first electric meters were introduced.

The first meters used were on direct-current circuits and depended on the amount of metal deposited by the electrolytic action of the load current; these were, therefore, ampere-hour meters and the design and construction of the first of these were due to Thomas A. Edison. This type of meter was objectionable from a number of standpoints and did not last long after Elihu Thomson brought out the watt-hour meter that bears his name. With the advent of the alternating-current, Schallenberger accomplished for that system what Thomson had already done for the direct-current system and service from both systems was sold thereafter on a watt-hour basis. The use of the watt-hour or kilowatt-hour basis for selling electric service was a vast improvement over the flat rate method that had been used previously and if electric service had always been restricted to lighting there would be no particular need for any measurements other than the kilowatt-hours. Early in the nineties of last century, however, the use of electric service for purposes other than lighting began to be recognized as increasingly important; electric service for power, electrolytic reduction and furnace work began to overshadow the electric light. At this period, began the era of the motor-driven factory, the electrolytic reduction of aluminum, the electrolytic purification of copper and the manufacture of carborundum and calcium carbide in the electric furnace. The use of electricity began to become more general than before; it was no longer simply a source of light as it was at the beginning, but a general service available for almost any purpose at any time. Then it began to be recognized that measurement of kilowatt-hours alone was not enough to give a logical basis for the fixing of rates for electric service. It began to be

recognized that load factor as well as kilowatt-hours of consumption must be taken into account in arriving at an adequate rate for such service.

Fixing a rate for electric service that is based on simply the kilowatt-hours of consumption is closely analogous to the problem of fixing the rental of a house or an office based on simply the "man-hours of occupancy,"if we may be allowed to coin such an expression. A perfectly just and logical basis for the amount of rent to be paid can be arrived at if we know the "man-hours of occupancy," provided we also have reasonably accurate information concerning the habits of the occupants. So also, a perfectly just and logical basis for the rates for electric service can be arrived at from the kilowatt-hours of consumption alone, provided we know the load factor (habits) of the load taken. However, if the occupants of our house or office begin to spend a larger part of each day indoors, it is evident that our former basis of rental becomes illogical. So also with the user of electric service; if he should begin to use his service for more hours per day, the rate that was established formerly would no longer remain logical. In other words, load factor must be taken into account if we would have a just and logical rate.

More than thirty years ago, or, to be more specific, in the year 1883, Dr. John Hopkinson of England first suggested the use of "maximum demand" as an item of first importance in the schedules of rates for such service. In his presidential address before the Junior Engineering Society (British) on November 4, 1892, on the "Cost of Electric Supply," he elaborated his ideas on this subject. So clearly did he show therein that the maximum demand, in addition to the number of "units" (kilowatt-hours) used is absolutely essential in arriving at the cost of supplying electric energy, that ever since, any method of fixing rates that involved the use of maximum demand has been known in general as the "Hopkinson method."

Since Hopkinson's first suggestion, there has been much discussion on this question of rates. Papers almost without number have been written on this subject of rates and every phase of the matter has received critical attention. For the past ten years the National Electric Light Association (U. S.) has issued a weekly bulletin entitled "Rate Research," and devoted to nothing else but a discussion of rates and closely allied subjects. Without exception, all authorities have recognized the correctness of Hopkinson's main contention, viz., that any logical rate for electric service must, in some manner, recognize maximum demand as well as the total kilowatt-hours of energy used, thereby taking load factor into account.

When we come to consider the question of how this maximum demand of a customer for rate-making purposes shall be obtained, we are at once faced with the fact that in general it is not obtained. When I say it is not obtained, I mean it in a relative sense. The electrical industries of Canada and the United States now absorb watt-hour meters at the rate of well over one million per year. The use of the maximum demand indicators of all types and descriptions probably does not exceed more than a fraction of one per cent. of this number and therefore in only this small fraction of the customers for electric energy is any direct attempt made to apply the Hopkinson method of charge. The watt-hour meter has admittedly reached a stage of development that leaves but little to be desired. The modern watt-hour

meter is accurate, cheap and relatively easy to maintain. However, it gives only one of the items of information that enters into a logical system of rates and makes no attempt to furnish any other.

"Hopkinson method" is a generic and not a specific term. There are many varieties of "Hopkinson methods." The inherent complexity of the rate question together with the long absence of any adequate method of measuring maximum demand has led in many cases to the practice of inferring the maximum demand instead of measuring it. In some cases for instance, it is the practice to base the maximum demand on the summation of all the name plate ratings of the motors connected. There are many objections to this practice. In the first place, it tends toward the installation of motors too small for their work with consequent motor trouble. Next, it makes for the misbranding of motors in placing name plates on them smaller than their actual capacity. Motor manufacturers are often asked to alter name plates for the purpose of its influence on the prospective customer's power bill. Next, it discourages individual drive for motor-driven appliances. Individual drive is coming to be recognized as best practice, and it is unfurtunate, to say that we should have another influence running counter.

Next, it is coming to be the practice of guaranteeing no overloads on motors and here again this practice runs counter to that of basing maximum demand on name plate rating. Again, the practice recognizes motors only and in this day of growing popularity of electric furnaces, heating devices and the many methods of using electric service, a method of inferring a maximum demand that rests on the name plate rating of the motors is deficient. Then finally, it is not a users potentiality to use power that should fix his maximum demand, but his actual use. MAXIMUM DEMAND SHOULD BE MEASURED, NOT INFERRED.

The first device that sought to fill the need first pointed out by Hopkinson was the so-called Wright Demand meter. This device was patented by Arthur Wright of England in 1893 and first appeared on the market about 1896 or 1897. This was an ampere demand meter and not a watt-meter; it, therefore, suffered the fatal defect that it recognized amperes of demand instead of watts and therefore penalizes the user of power whenever the voltage is low. The user is not responsible for low voltage and therefore the system of rates based on amperes of demand instead of watts inflicts a penalty for a condition for which the user is not responsible—a position that is quite untenable for a supplier of power. In addition, the Wright meter as designed and used had no method of compensating for the heat that flowed in to or out of the active air chamber due to heat conduction in the lead wires. Judging from the results of tests, this defect alone is apparently sufficient to condemn the device independent of the consideration that it is an ammeter instead of a watt-meter.

There are three recognized types of demand watt-meters in use to-day. They are:

1st— The Thermal Storage Type.

2nd—The Mechanically Lagged Type.

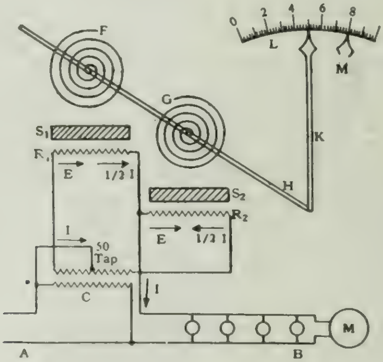
3rd—The Merz or Block Interval Type.

The characteristics of these types will be described in the order named.

1ST—THE THERMAL TYPE.

The theory and characteristics of this type are fully given in two papers by the author in the A.I.E.E. proceeding of October 8, 1915 and February 15, 1918. Some of the material from these two papers is quoted in this paper.

The operation of the thermal watt-meter is shown diagrammatically in Figure 15, in which A is a single-phase circuit feeding a load B. A small transformer C is incorporated within the meter with its primary across the circuit A. In series with the secondary of this transformer are two equal resistances R_1 and R_2. A current is of course set up in these resistances that is proportional to the voltage of the circuit A. The load current is also caused to circulate through these same resistances as shown in Figure 15, being taken into the middle of the secondary or the small transformer and out at the connection between resistances R_1 and R_2. These two currents—one the secondary current, due to the presence of the voltage and the other due to the



(Fig. 15)

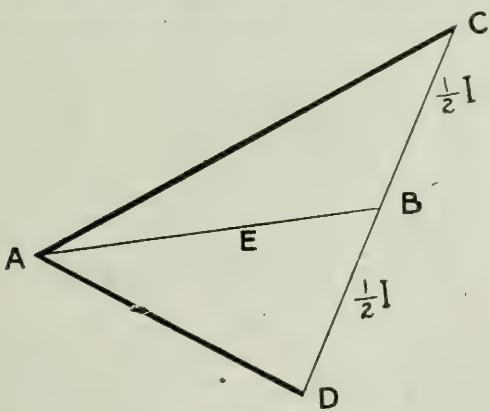
passage of the load current—are additive in one of these resistances and subtractive in the other, and the difference in the heating effect of the two resultant currents is proportional to the wattage of the load B.

If the current that passes through the resistances R_1 and R_2, due to the presence of the voltage, is represented by E, and the load current therein by I, the resultant current in one of these resistances is E plus $\frac{1}{2}$ I, and in the other E minus $\frac{1}{2}$ I. The difference of the losses in R_1 and R_2 is proportional to the product EI.

F and G represent two spiral springs made from bimetallic strips, attached rigidly to their casings at the outer ends and to a common shaft H at their inner ends. These bimetallic springs tend to uncoil on an increase in temperature (due to the difference in temperature coefficient of the two metals of which they are composed) but, since the two springs are wound in opposite directions, no movement of the shaft H will take place unless there is a difference in temperature between F and G. The shaft H, therefore, will not turn with changes in atmosphere temperature or with any other condition that causes both springs to maintain the same temperature, but will respond

only to the difference in temperature caused by the difference in the losses in resistances R_1 and R_2. S_1 and S_2 represent diagrammatically the thermal storage of the cases in which the bimetallic springs F and G are enclosed. Due to this thermal storage, the watt-meter does not respond instantly to a change in load but always indicates the logarithmic average load over the time period immediately preceding the instant of observation, the length of this time period being determined in part by the amount of thermal storage of the cases. K is a pointer attached to shaft H and travelling over the scale L. M is a friction pointer which shows the highest position of pointer K since last reset.

That the indications of such a device will correspond to the watts independent of power factor is indicated graphically in Figure 16. Suppose AB, Figure 16, is the value of the current that flows through the resistances R and R_2 due to the secondary voltage E in the transformer C of Figure 15.



(Fig. 16)

Suppose further that CD, Figure 16, represents both in magnitude and phase angle the load current I that flows through these same resistances. It is obvious that the resultant current in resistance R_1 is proportional to the distance AC Figure 16 and that in R_2 is proportional to AD. If AB and CD are in phase the resultant currents are respectiveley $E+\frac{1}{2}$ I and $E-\frac{1}{2}$ I. Since the heating effects are proportional to the squares of these values, the indication on the scale is proportional to $(E+\frac{1}{2}\text{ I})^2-(E-\frac{1}{2}\text{ I})^2=2\text{ EI}$. If AB and CD are 90 degrees out of phase with each other, it is obvious that the two resultants will always be of the same value. For any other angle, or for any wave shape, it can be proved mathematically* that the watts are proportional to AC^2-AD^2 and this is the value that is measured by the thermal demand meter.

The quantity measured by the thermal storage demand meter is the average watts over a certain time previous to the instant of observation, rather than the instantaneous watts measured by an ordinary watt-meter.

---

*Such proof is given in Appendix II of a paper entitled "Rates and Rate Making" Trans. A.I.E.E., Oct. 8, 1915, Vol. XXXIV., p. 2313.

Further, the average so measured is not the arithmetical average but what is called the "logarithmic" average. In other words, the indication of a thermal storage watt-meter is not that due to the watts passing at that instant, but is the resultant of all the wattage flow that has passed, each instant of past flow having a value influenced in respect to its time proximity by a logarithmic law. When the word average is used in its commonly accepted sense, it is assumed that each instant of time over which the average is taken has equal weight. In the resultant that is obtained by a heat storage meter, each instant of time has not an equal weight, but the influence of each instant decreases with its remoteness in point of time, and the degree by which the watts during any instant influences the total indication is proportional to $_e$-KT where e is the base of Napierian logarithms, K is an adjustable constant, and is the time measured backward from the instant of observation. For steady

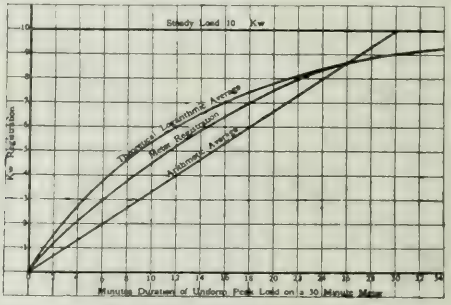


Fig 17

loads, the logarithmic and arithmetical averages are the same. The same is true where the load is fluctuating provided the fluctuations in load are comparatively rapid. For instance, if the load fluctuations are continuous and do not exceed two minutes in duration on a thirty minute meter, the results on the logarithmic and arithmetical average meters are the same. For isolated peaks of load, the logarithmic average meter responds to the increment of load in excess of the previously existing steady load in a manner that will give results close to but not necessarily identical with the arithmetical average. For instance, the arithmetical average or an isolated peak load for a time duration of more than about 26 minutes will be greater than the registration of a 30 minute thermal demand meter, the maximum value of the difference being 10 per cent. of the increment of the peak load over the previously existing steady load, as shown in Figure 17. For peak load durations less than about 26 minutes the arithmetic average will be less than the logarithmic average registered by the thermal meter, the percentage difference increasing as the duration of peak load decreases as shown in Figure 17. For example, if a 10 k.w. load is applied to a 30 minute thermal demand meter for five minutes, it will register — providing the previous load has been zero — about 2.64 k.w. of demand while the arithmetical average of that same five minute peak over the 30 minute period would be 1.67 k.w. If the peak should last for twenty minutes instead of five minutes, the thermal meter would

register approximately 7.54 k.w. of demand as against 6.67 k.w. by the arithmetical meter. As indicated above, at about twenty-six minutes of load duration, the indications of both types of meter would be identical. In brief, for a short time duration of peak load, the arithmetical average is lower than the logarithmic average; for longer periods of time, the arithmetical average is slightly higher than the logarithmic average, while for very long durations, exceeding twice the time period of the meter, there is no appreciable difference.

The logarithmic characteristics of the thermal demand meter is of advantage, because such a device recognizes the heating and this is the quantity after all that should be recognized, since it is that which fixes the limiting capacity of the equipment necessary to furnish the service.

If the character of load is known, the indications of a thermal storage demand meter can be determined by analysis in the manner outlined in the 1918 volume of the A.I.E.E. transactions, pages 162-165. The results of such an analysis on certain specific types of load are given later in this paper.

2nd—The Mechanically Lagged Type.

In this type, an indicating watt-meter of any standard type is associated with a standard watt-hour meter in such a way that the indications of the indicating watt-meter are delayed by the action of the watt-hour meter. An escapement is attached to the indicating watt-hour meter so that it cannot advance instantly as in the usual meter but can advance only a certain definite amount for each revolution of the watthour meter. A ratchet is provided so that the indicating watt-meter may recede instantly but the next advance when it occurs is again retarded by the watt-hour meter. The characteristics of this meter therefore, are that it will always advance at a rate proportional to the total load passing while it recedes instantly. The characteristic of advancing at a rate proportional to the total load instead of the increment of load causes this meter to read high whenever short time increments load are superimposed on a previously existing steady load and the characteristic of receding instantly causes it to read low whenever the load is such that it returns to zero or some other low value. The Westinghouse type "RO" demand meter is the only one of this type that has been manufactured to date.

If the character of the load is known, the indications of this type of meter can also be determined by analysis. The results of such an analysis on certain specific types of load are given later in this paper.

3rd—The Merz or Block Interval Type.

In this type of demand meter a standard watt-hour meter is associated with a clock or other timing device in such a way that the number of revolutions of the watt-hour meter disc during some definite interval of time are determined by the device; at stated intervals a definite and fixed time apart the clock or other timing device sets a register back to zero. The watt-hour meter then advances this register during the ensuing time interval. At the end of the interval the clock or other timing device again resets the register to zero and the process of advancing begins again. A maximum register indicates at the end of the month the maximum advance that has taken place during the month or since last reset. The inherent defect in this type is that it may "split" the peak when the time duration of the peak is less than the

time interval of the meter. The Merz or block interval type of demand meter therefore, measures the arithmetical average of the watts over a definite time interval but the maximum time interval so measured might not correspond with the actual maximum. It however, has the vital advantage that its indications are "safe." If any device used in determining a customer's bill favors the company supplying the service, it can be successfully attacked by the customer while if the contrary is true, it cannot. Hence, the indication of this type of demand meter are "safe" since it cannot over register. Another disadvantage of the "block interval" demand meter is that two or more of them applied to the same load will rarely check each other. This characteristic follows from the fact that it is impossible to synchronize the clocks or other timing devices used with these meters and therefore, the time intervals of the various meters do not correspond. The actual peak may be split in various ways by the various meters used and hence the readings will not correspond.

The best method of visualizing just what these various types of meters will indicate is to show by analysis what each type will read with a definite and specific character of load applied. In Figures 4 to 16 inclusive, (pages 130-133) this is done for thirteen definite types of load. The number of possible types of load is of course infinite and it is impossible to consider them all. However, the types considered in Figures 4 to 16 (pages 130-133) are more or less typical of actual loads and at least will give a general idea of what each kind of meter will do on a given kind of load.

The type of load considered in Figures 4 to 8 (pages 130-131) is a continuous steady load with superimposed peaks of certain definite character. All load values are so chosen that the arithmetical average over the maximum thirty minutes is 100 per cent. Thirty minutes has been taken because the results of these particular loads have been carefully checked on a thirty minute thermal meter. The results are relatively the same on a ten minute period as these figuress how for a thirty minute. In general, for this type of load, the thermal demand meter reads slightly above the arithmetical average, by an amount depending on the increased heating effect caused by the superimposed peaks; the mechanically lagged shows an excessive over registration; the block interval meter shows the arithmetical average over thirty minutes with a "coefficient of indefiniteness" that increases with the amount of the superimposed peak.

Figures 9 to 13 (pages 131-133) show the results of the various types of meters with isolated blocks of load of various times of duration. Here again the arithmetical average of the block is selected so as to be 100 per cent. over a thirty minute period; the results however, would be relatively the same if any other time periods were considered. In general, for this type of load, the thermal meter reads higher than the arithmetical average—except Figure 13 (page 133)—and the excess in each case is due to the higher heating effects of short time high peak loads; the mechanically lagged meter reads the exact arithmetical average; the "block interval" meter reads the arithmetical average as a maximum and has a "coefficient of indefiniteness" of 50 per cent. It will benoted that the excess of the thermal meter over the arithmetical average is very marked when the demand is confined to a short inter-

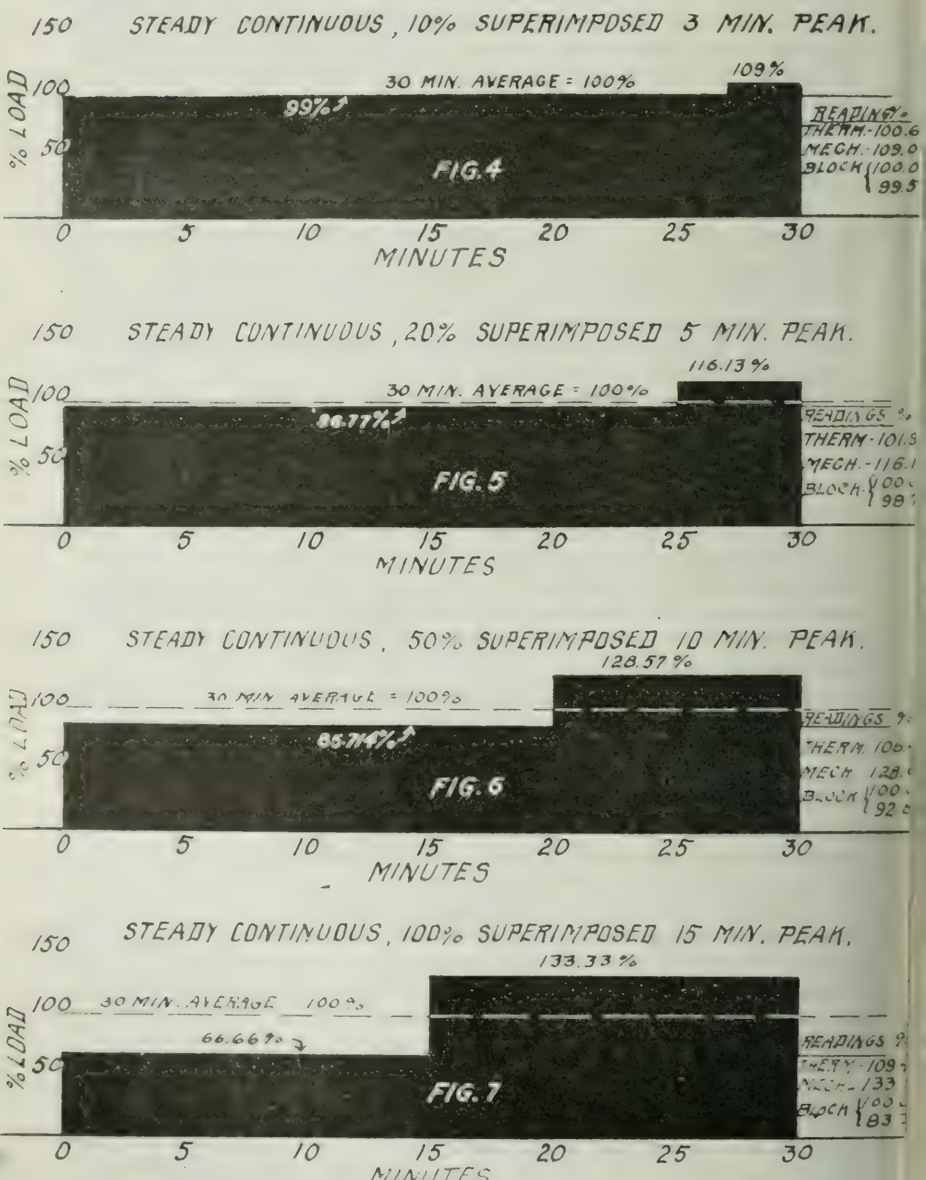
val. For instance, in Figure 9 (page 131) a load of six times normal for one sixth of the normal time period is shown and in this case the thermal meter reads 158 per cent. of the arithmetical average. I consider this a perfectly logical result since the heating effect of a load of six times normal for one sixth the normal time is much greater than if a normal demand had been spread over the entire thirty minutes. A customer who insists on taking his entire thirty minutes quota of power in five minutes and then takes nothing for the other 25 minutes obviously should be penalized for taking his load in this way. The thermalmeter inflicts this penalty automatically; it recognizes the true heating effect of a given load no matter how it is taken.

Figures 14 to 16 (page 133) show the results on the various types of meters when the load is constantly fluctuating over wide limits. Here again the arithmetical average over the maximum thirty minutes is 100 per cent. but the results would be relatively the same on any other time period. In general, the thermal meter reads slightly above the arithmetical average—the excess being governed by heating effect as in the other types of load; the mechanically lagged meter reads only a fraction of the arithmetical average load; the block interval meter reads the arithmetical average as a maximum and has a "coefficient of indefiniteness" which is considerably affected by the exact character of the load. The low reading of the mechanically lagged meter is due to the characteristic that causes it to follow a receding load instantly.

While many other types of load might be shown, it seems that these thirteen examples will give a sufficient idea of the characteristics of the various types of meters to enable prospective users to judge of their respective merits. Actual tests with meters of various types and of various time periods on loads of various kinds would be highly interesting and it is hoped that such tests can be made.

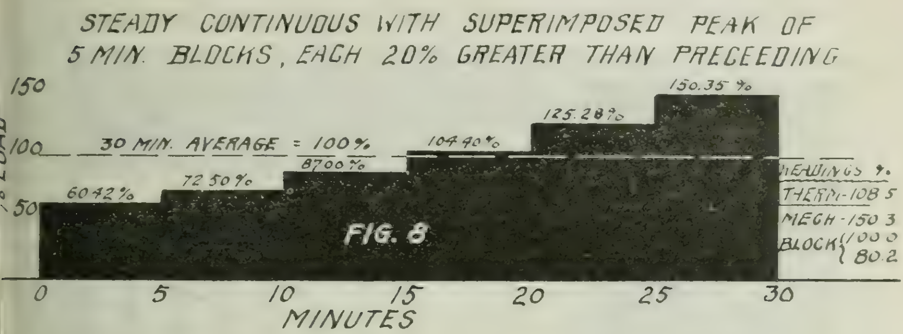
There is one further point that deserves some discussion before this paper is closed. One can logically take the stand that if the heating effect of a given load over a specified time period is to be taken as the basis of maximum demand measurement, then power factor certainly should be considered also in arriving at the demand. Heat depends on volts and amps. In other words, the demand should be based on K.V.A. instead of K.W. This I am perfectly willing to admit. The difficulty comes in measuring K.V.A. of demand instead of K.W. There are methods now in use of measuring K.V.A. of demand but they are very expensive methods and it is only the largest customers that bring in a sufficient revenue to justify the measurement of K.V.A. While it is quite possible that the cost of measuring the K.V.A. of demand can be brought to a lower figure than at present, it also seems that the measurement of the K.V.A. of demand will always be more expensive than the measurement of K.W. I see no prospect that this situation will ever change. It is therefore, my recommendation that programs for the measurement of demands shall not be held up awaiting the appearance of a device to measure the K.V.A. of demand. There is no doubt that such a device is coming and that it will appear shortly; there is also no doubt but that its costs will put it beyond the reach of all but the largest users of service. The ability to measure K.W. of demand both accurately and cheaply is now

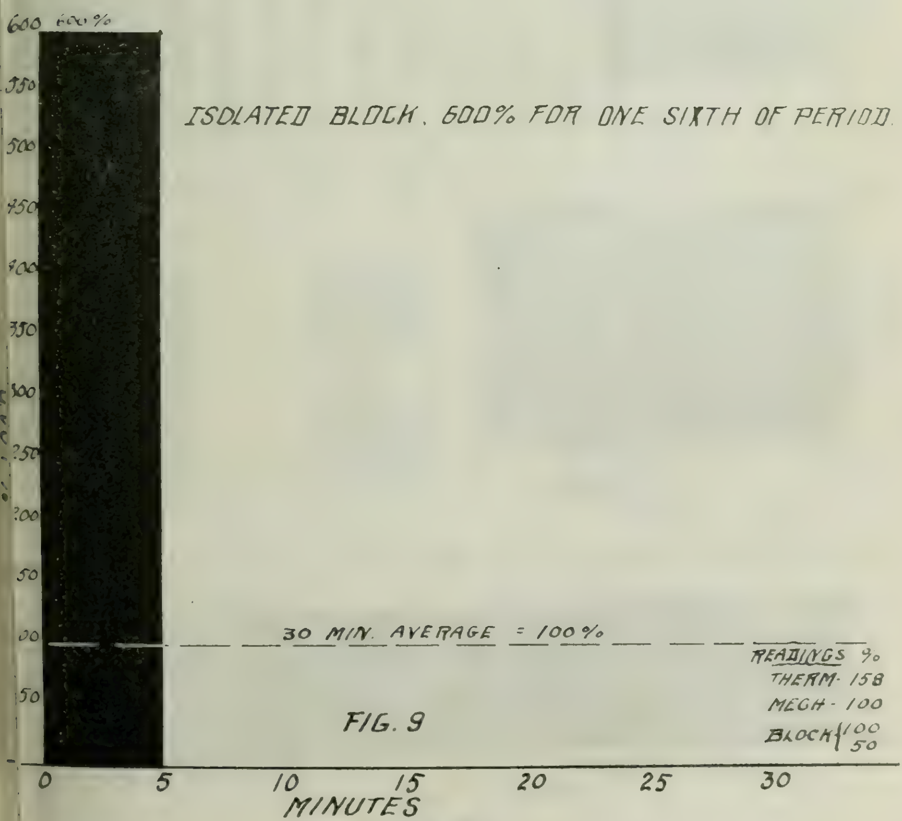
here and this ability should be made use of. We must govern our conduct not by the ideal but by the actual. The ideal is the measurement of demand on a



(Fig. 18)

K.V.A. basis; the actual is that while this is possible, its cost is so high that it is inapplicable to all except the more important customers.

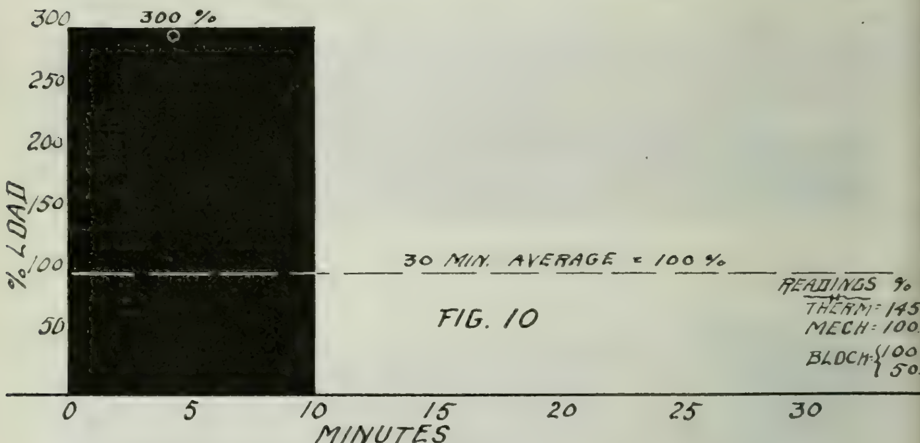




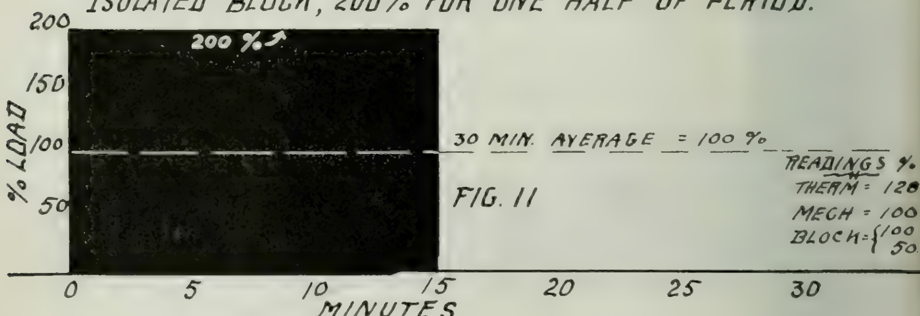
(Fig. 19)

THE CHAIRMAN:—We have listened with a very great deal of pleasure I am sure to Mr. Lincoln's interesting and instructive address regardless of

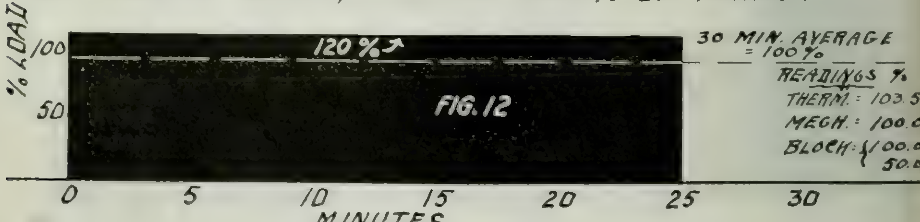
ISOLATED BLOCK, 300% FOR ONE THIRD OF PERIOD.



ISOLATED BLOCK, 200% FOR ONE HALF OF PERIOD.

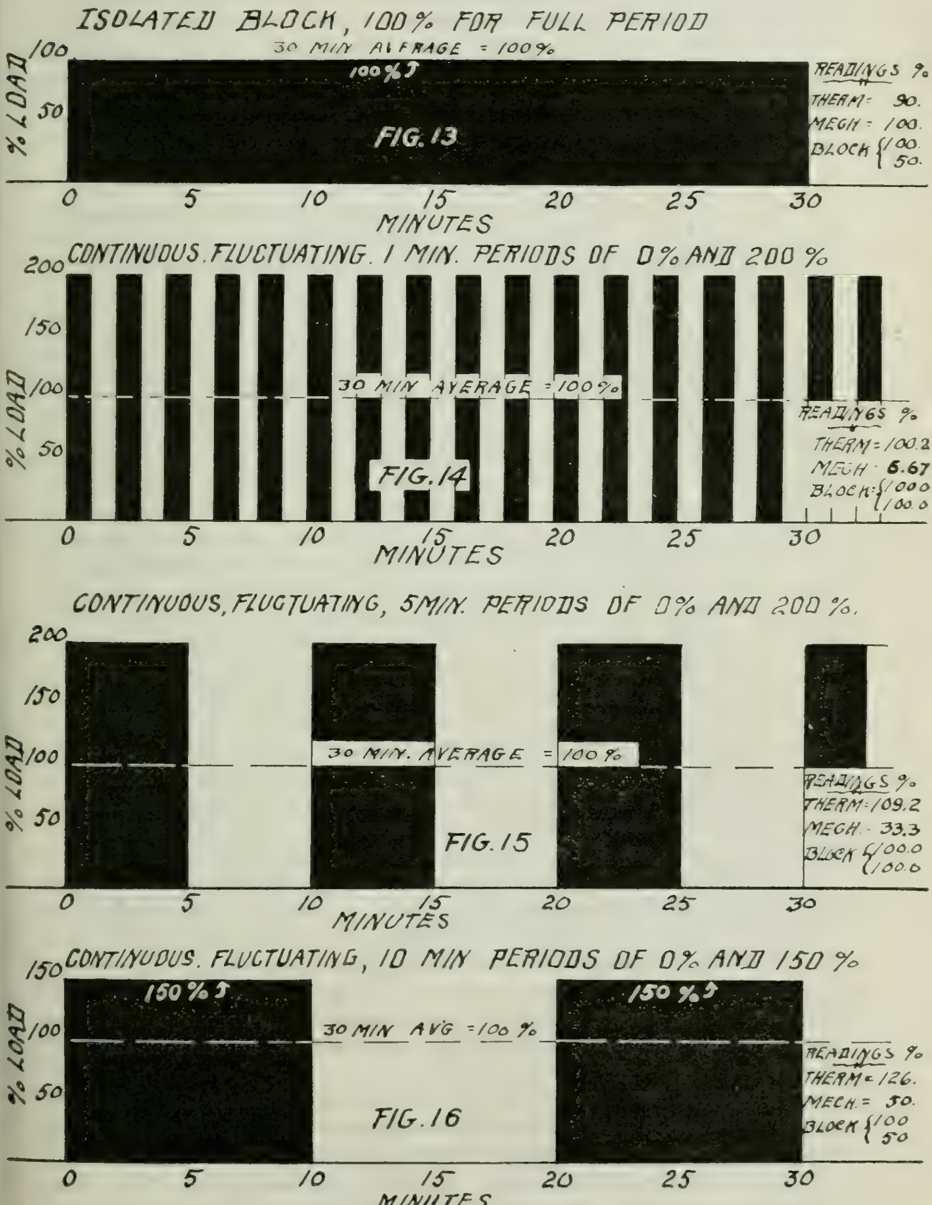


ISOLATED BLOCK, 120% FOR 83.3% OF PERIOD.



(Fig. 20)

our technical qualifications, and I am sure we have all added to our store of knowledge. Is there any discussion on this paper, gentlemen?



(Fig. 21)

THE SECRETARY:—With respect to the points that Mr. Lincoln raised in connection with the thermal demand meter registering higher on isolated peaks I feel that this is a very good point and I thoroughly agree with him that the customer who demands a load of that type and where the Central Station Company must maintain a service available to supply him with a load of that type, the cost of supplying this demand is very much higher than with a normal customer, and that the company is justified in billing him on the basis of a higher demand such as thermal storage meter will give for that type of load.

THE CHAIRMAN:—Any other remarks?

MR. HOLDER:—I would like to ask Mr. Lincoln in regard to the specifying of the demand. We have in our contracts specified very definitely upon what the demand is to be based. How would he word that specification when using the Lincoln demand meter?

MR. LINCOLN:—Well, Mr. Chairman, that is a question that I have devoted some considerable attention to, particularly when this type of meter was first proposed and I went so far at that time as to submit that question to the then chairman of the Standards Committee of the American Institute of Electrical Engineers. It was his opinion at that time that the language adopted by the American Institute of Electrical Engineers in defining demand and maximum demand was properly met by the thermal storage meter. I have forgotten the language. Any of you who have a copy of the standard rules of the American Institute of Electrical Engineers can find that language. The language, roughly, is that the demand is the amount of power taken not instantaneously, but over a suitable and stated interval of time. That is not the exact language but approximately the language. Now, it was the opinion of the then chairman of the Standards Committee of the American Institute of Electrical Engineers that the quantity measured by the thermal storage meter would be properly covered by that definition of demand, and if that language or language similar to that used in the American Institute's standardization rule is used in your contracts, I believe that it would be as well met by the use of the thermal demand meter as by any of the other types of demand meters. That, as I say, is an opinion which I got from Prof. Adams some years ago, who was then the Chairman of the American Institute of Electrical Engineers. The only thing I can suggest, therefore, is that you use in defining demands in your contracts, language similar to that which is used in the American standarization rules. That will undoubtedly pass criticism of whatever bodies may be called upon to review such a contract. It would be my suggestion to use that language.

MR. HOLDER:—The exact wording is:—"It is determined by measurement according to specifications over a prescribed time interval." That specification is the point. How would you specify it? Further in the rules it says:

"The maximum demand of an installation or system is the greatest of all demands which have occurred during a given period. It is determined by measurement, according to specifications, over a prescribed time interval."

MR. LINCOLN:—That is in the American standardization rules. That is the language which, according to the then Chairman of the Standardiza-

tion Committee, would be acceptable if obtained by thermal storage meter.

Mr. P. S. Gregory:—Power contracts usually state that the maximum demand charged for shall be based upon an integrated demand for a period of 10 or 15 or 30 minutes, as the case may be. Do you furnish a different meter for these different demand intervals.

Mr. Lincoln:—It is a question whether the term "integrating" there would be met by the thermal meter. In my opinion it can be. A thermal meter does not give an instantaneous value, but it does give what I think can be properly described as an integrated demand over a certain definite time interval. I believe that the term "integrated" would still be met by the thermal meter.

Now, the question as to various time periods. The only time period we can offer in Canada at the present is ten minutes. However, if there is a demand for longer time intervals than ten minutes they can be supplied. I might say, possibly many of you know that the Westinghouse Company in the United States is handling this meter for distribution to the trade in the United States, and they are supplying to that trade meters of two periods —15 minutes and 30 minutes. As I say, the only time period that has been supplied to the trade in Canada as yet is the 10 minute, but the others can be made and will be made as soon as the demand for the other time periods arrives at such a point that we are justified in the additional tool equipment, etc., that will be made necessary by another time period. It requires some change in the meter. The time period depends entirely on the thermal storage and certain parts must be made considerably heavier for the longer time periods.

I want to say further that 10 minutes is probably about as short time period as we can get. The reason for that is that the present 10 minute meter has the part enclosing the heaters made about as light as we feel justified in going for mechanical reasons. If we go to lighter parts we might reduce the time very slightly but the reduction would be slight and we fear that such construction would not be satisfactory for mechanical reasons. However, I do not believe that shorter time periods can be justified from another standpoint, and that is that there is no electrical equipment furnishing power which has an inherent time period of its own, of less than the ten minutes we are offering. Motors, transformers, generators, cables, everything that enters into the equipment of getting power from the water or the steam, as the case may be, into the customer's premises all have time periods considerably in excess of ten minutes. Standard motors of 15 to 20 h.p., on which I have made quite a number of measurements have time periods something of the order of one hour or more. When I say time period of a motor, I mean that if you put a steady load on cold motor it will finally get up to some 35 or 50 degrees above the surrounding air and it will reach 90% of the final temperature in approximately one hour. That is true for motors. For transformers the time periods are considerably longer. Take some of our big transformers, self-cooled oil-insulated, and tests on those have shown that it takes well over 24 hours for them to arrive at 90% of their final temperature with steady load applied. Those are excessive and apply only to that type of equipment. But the thing I want to point out is that there is

none of the electrical equipment which enters the supplying of service which has an inherent time period shorter than ten minutes. Ten minutes, I think, is as low a time period as we are justified in adopting. We can give you longer time periods and we will do so when the demand for these longer time periods will justify the tool equipment necessary to produce them.

I might say further in that respect that in some of my earlier experiments on thermal meters, I have passed the current of the meter directly through the bi-metallic springs themselves. By that method I got down to time periods of little over a minute. I did consider at one time building meters for the market on that basis but after further consideration I abandoned the idea. The temperature which the springs would arrive at on short circuit, which may last only a fraction of a second, might easily cause the bi-metallic spring material to arrive at a temperature where all temper would be taken out of it, and, therefore, valueless. Such a meter I do not believe would give satisfaction and I think it would be useless to produce a meter of that kind. In other words, ten minutes is I think about as low as we could get, and I think that the considerations which I just gave will show that ten minutes is about as low a time period as we would be justified in putting into actual use.

THE CHAIRMAN:—Professor Herdt is here, would he contribute to the discussion? Mr. Pratt, would he have anything to enlighten us on this important subject. I am sure the proper measurement of our product is of great importance.

MR. PRATT:—At first I was of the opinion that the thermal meter would not be satisfactory for intermittent loads such as steel rolling. We have such a customer on whom we have a graphic meter. Unfortunately our time period is set too high and we do not begin to catch his peaks, but those who have followed carefully Mr. Lincoln's description of results obtained by the thermal meter with intermittent loads, will have learned that instead of the meter not being suitable for that class of business, it is eminently the thing. This was the only point that I was uncertain about until it was so fully set forth in this morning's paper.

MR. CHAIRMAN:—Mr. Dion, might we have a word from you?

MR. DION:—I have nothing to say.

THE SECRETARY:—I might ask Mr. Lincoln a question that comes to my mind in connection with the Lincoln meter. There is one point that enters into this from the company's standpoint, especially with respect to the meter room. Most of our companies, especially the larger ones, have a number of different types of meters to look after to repair and calibrate. That means carrying a stock of parts for the various types of meters which they have in their work. I was wondering if Mr. Lincoln could tell us what the proper method would be to handle the repairs of damaged meters or re-calibration or anything of that kind in connection with it.

MR. LINCOLN:—I am going to ask Mr. Lines to answer that question.

MR. LINES:—Mr. Chairman, in case of lightning or overload damaging the meter, it is somewhat difficult for your meter men to repair this instrument. We realize that situation and also from a study of the meter we feel that the number of meters damaged in that way will be quite small. Therefore, if you get any burned out meters, either by lightning or otherwise, send them back

to the shop and you will not get a bill. That will probably be cheaper than having your own men do the work.

MR. PRATT:—One point has occurred to me that I would like to ask, and that is, has the Lincoln Demand Meter been submitted to the Government Meter Testing Bureau for approval in order that it may be sealed up?

MR. LINES:—The meter was submitted to Ottawa 12 months ago. At that time they sent out a notice which read that it had the approval of the Department but must not be sealed. A week after we got a notification saying that was a typographical error and the meter must be sealed. That has left some confusion in the minds of the Government Inspectors. Therefore, if you ask the Government Inspector, he may be doubtful in his mind whether they have got to be sealed, but he will generally tell you that they can be sealed if you ask for it. At a later date we made suggestion to the Department at Ottawa, that all meters be sealed in our factory before shipment. The meter is such that transportation is unlikely to damage it and it would simplify the situation for all concerned and make the cost to the government very much less. They viewed this with some considerable favour but in the discussion the question came up as to whether the meter came under the Act. The Act, as I understand it, reads that they must inspect and seal all meters which determine the amount of the customer's bill as applied to the kilowatts the man used, but the Act does not determine the rate at which these kilowatts are to be charged. Now, in the case of a lighting customer in Ontario, and I think in Quebec as well, the Companies state the number of k.w. hours the man is to use at the high rate, based either on measurement or inspection, and then give him a lower price for all over this figure, so that the meter is this case would be an instrument for determining the rate per k.w. which the customer is to be billed. In a case where you bill for the h.p. at so much per h.p., namely 100 h.p., at $1.00 per h.p. then the meter should be sealed under the Act. But if you say his demand is 100 k.w. therefore he has to burn 1000 k.w. hours at 9cts. and all after that he gets at 5cts., then it does not come under the Act. The position is very complicated and is now before the Department of Justice to decide whether the demand meter comes under the Act or whether it does not.

I think the position is, you can get the meter sealed if you want it, but they will not enforce its being sealed until the decision is given.

Since making the above statement I have been informed that the sealing of the Lincoln meter is optional also that it may be sealed at our factory before shipment.

MR. HOLDER:—Another point that comes up in connection with the ten-minute meter register, why should not that meter be marked a fifteen minute interval meter instead of ten minutes? Why is ten minutes selected?

MR. LINCOLN:—Well, that is a question which, if pursued to its logical conclusion, would lead us into some higher mathematics. It is perfectly true as you showed—and the curves showed on the screen there—if you put a steady load on the thermal meter it arrives at its final indication after a time, and it is perfectly logical to call the time period of that meter anything less than this somewhat indefinite time. The reason for adopting the 90% point as the rating of a meter was that the General Electric Company some years

ago brought out a meter which used that percentage. That meter was based upon the principle of the ordinary integrating type of watt-hour meter working against a series of springs. When the driving torque became equal to the backward torque of the spring the meter stopped advancing so that the type of indication which that meter gives is exactly similar to the one which is obtained on the thermal principal upon which this meter rests. In that case, the General Electric Company adopted the time to arrive at 90% of the final value as the time period of the meter and in adopting the same practice, I anticipated less resistance. However, on that question I do not see why we cannot adopt some other percentage as the time period of the meter. It might be somewhat confusing but for certain specific cases I do not see why that cannot be done, and if there is a desire that it should be done I think we are perfectly willing to do it provided, of course, that the user of the meter understands exactly what is being done. To go into the mathematics of the thing for a moment.

If a steady load be applied to a thermal meter, the relation between its indication and time is expressed by the formula $I = 1 - e^{-kt}$.

Where I is the indication of the meter, e is the base of Napierian logarithims; k is a constant, t is the time elapsing after the beginning of the steady load application.

The time period of the meter simply depends on the value adopted for the constant k. When the exponent kt is equal to 2.302; the quantity e^{-kt} becomes .1 and $1 - e^{-kt}$ becomes .9. Therefore, if we take $k = 2.302$, the meter will reach 90% of its final indication in unit time. If we should take 95% of the final indication as the unit time instead of 90%, k would have the value 2.996 instead of 2.302. If we assumed 80% of the final indication as unit time, k would have the value 1.610. For $k = 1$ the unit time becomes 63.21% of the final value. In taking unit time at 90%, or $k = 2.305$, I have simply followed the lead of the General Electric Co. with a meter that follows the same law.

THE CHAIRMAN:—Any further discussions? I am sure in closing this discussion I can express to Mr. Lincoln your appreciation of his very interesting address on this meter subject. At the afternoon session we will have the honour and the privilege of listening to an address from President Insull, of the National Electric Light Association. Mr. Aylesworth, who was to have been here, was unavoidably detained. I trust we will have a big attendance at the afternoon session as President Insull will have something to say to us of very considerable importance to the members of the Canadian Electrical Association. There is also a paper by Mr. Colville of the National Lamp Works on The New Viewpoint on Modern Lighting.

Meeting adjourned at 1.00 p.m.

AFTERNOON SESSION

JUNE 17, 1920

THE PRESIDENT:—I now have the great pleasure of making special mention of the fact of the great honour which is done to us by the visit of Mr. Martin J. Insull, the President of the National Electric Light Association, who will address us this afternoon.

I shall not waste your time by making observations now but I should like to assure Mr. Insull in advance that it affords us the greatest possible satisfaction and sense of honour in having him with us this afternoon, and I now have a very great pleasure in asking Mr. Insull to address us.

Mr. Martin J. Insull, who was received with applause, said:—

Mr. President and gentlemen of the Canadian Electrical Association, I would like to correct one slight mistake your president made. I am not yet the president of the National Electric Light Association, as I do not take office until July 1st. I am the president-elect.

Since I have been here I have been very envious of one thing, and that is your chairman's great facility of speech, I am sorry I cannot bring a like facility to my remarks, but I will do the best I can.

I am asked to speak to you with reference to the National Electric Light Association of the United States. That Association during the past year has made some very forward steps under the guidance of Mr. Ballard, the retiring president, who is Vice-President of the Southern California Edison Company. Mr. Ballard brought to the Association a great deal of original thought and a great deal of energy. He has, in my opinion, started the National Electric Association on a programme which will lead it to be a very great factor in the electrical industry of the United States. It always has been a great factor but if the plans that he started, and which I have pledged myself to follow out, are carried forward to their logical conclusion it will in my opinion be a very much greater factor in the future than it has been in the past.

Under the new plan of organization the United States will be divided up into twelve geographical sections. Those geographical sections will each have an organization similar to that of the National Association itself. It is our feeling, and I am sure that we feel rightfully, that it will make the National Electric Light Association far more national in its character in the future than it has been during the last few years. These geographical sections have been formed or are being formed—most of them have been formed—and the plan has met with general favour from the people in the industry all through the States. As most of you are aware, the operations of the National Electric Light Association are carried on by what are known as National Sections. In the future there will be four National Sections; a Techinal Section, Accounting Section, Commercial Section and a new section which was formed at the Pasadena Convention, called The Public Relation Section.

A number of you gentlemen are probably very much interested in the Technical Section. The activities of that section are going to be materially increased I think over what they have been in the past. In connection with that section there has been engaged at the National Headquarters in New York, an engineering staff which will be on hand for the purpose of promptly taking up engineering questions. There has been engaged for that work Mr. Canada, who was for a number of years connected with the Bureau of Standards of the United States and also a Mr. Fowle, of Chicago, who has done a great deal of work on the question of inductive interference. I do not know whether you have that problem in Canada to the extent we have it in the United States but the question of inductive interference in connection with

power and telephone lines has become a great problem for us in different sections of the United States and it is a matter that the Association feels should receive a very great deal of attention. Mr. Fowle will pay particular attention to that work, while Mr. Canada will take up questions of general engineering and of the relation of the electric light and power industry with the Bureau of Standards at Washington with a view to having their rules so formed as to be satisfactory to the industry.

In addition to the engineering staff we will have a Consulting Engineering Committee that will deal with the larger problems that we may bring to its attention. As this will be a rather remarkable committee, I think you will be interested in knowing about it. The Consulting Committee is to consist of Professor Elihu Thomson, whom you all know, Dr. Kennelly, whom some of you know, and who was for many years connected with the work of Mr. Thomas A. Edison in his labatory and now, as I remember it, a professor of electrical engineering in Harvard University. Associated with those two gentlemen will be Mr. Scott, who used to be chief engineer of the Westinghouse and is now Professor of Engineering at Yale University. These gentlemen will sit as a Consulting Engineering Committee, before whom our Technical Section can bring some of the larger engineering problems of the industry and get the benefit of their wide knowledge and experience in not only the theoretical side but also the practical side of our work.

With regard to the other sections—I am speaking now of the Accounting and Commercial sections—they will continue to work as they have in the past.

The new section, which is the Public Relations Section, is one that from my point of view I think has some of the most important work that has to be done by the Association during this coming year. I am naturally not as familiar—I would say, not familiar with public relations conditions in Canada,—while I am reasonably familiar with the public relations conditions in the United States. My own business takes me into some 15 States in which the company which I represent is interested in utility properties, and naturally I have some knowledge of the general feeling all through the United States.

One thing we have to combat at the present time, and we have got to do it reasonably soon, is the suspicion with which public utilities securities have been looked upon during the past two years. There is really no reason in my opinion for that feeling of suspicion. It has largely grown up in the United States, I think, through the fear which the investing public have with reference to any regulated business. When you look back over the last few years I think we can all feel that the electric light and power companies have been through about as hard a time as they could possibly have had and have weathered the storm with very, very few wrecks. In fact I cannot at the moment think of any particularly large companies that have been wrecked in the financial chaos of the past few years. While in the United States we may not have been treated by all the commissions as well we would have liked, still, on the whole, I think we have been treated very fairly indeed. The companies that I know most about have, as a whole, been treated in their various states very fairly by the commissions. They have received increased rates where we required them. In some cases there has been unnecessary

delay in giving the increases that were required, but take it all in all, they have been treated very fairly as their figures today show, as notwithstanding the large increase in the cost of operation they are showing reasonably good net earnings. However, the investing public do not seem to understand the real situation, and I think it is up to the Electric Light and Power Industry to bring it to their attention and educate them on the fundamental principles of the Electric Light and Power Industry. I do not think that they appreciate its necessities; and it is only by our own efforts that we can bring them to realize the absolute necessity of our existence for their comfort and for their business. They should be made to understand that we must be allowed a fair return on the money invested and enough of a return to continually attract the capital which the business requires. It is along lines of this kind that we expect our Public Relations Section to do its most efficient work. It is really a section whose business is to educate the public up to the necessities and the requirements of our great industry.

The geographical sections will have the same sections in them as the National Sections to which I have referred. So that while the National Association Committees will be working through its geographical sections, the various national sections will have inside the geographical sections similar sections working for them all over the country. We expect in this way to have the whole country organized. This seems to me to be particularly important, in view of our Public Relations Section. We have today in a number of States already organized committees whose sole duty is to send out educational matter to the various newspapers in their territories. In Illnois this is being carried to a very large extent and we are already beginning to see an entire change in public opinion in the State of Illnois with reference to the relations between the Public Service companies and their customers. There is far less antagonism to the Public Service companies in their applications for increased rates before the Illnois Commission than there was before this Committee on Public Utility Information came into existence.

That campaign we are carrying on in this way: Each week we send to the editors of the various papers all through the State of Illnois certain news items bearing on the public utility question and while at first these items were not used to the extent that we had hoped, still as time went on they became used more and more, until only recently all through the State of Illnois, newspapers have been running editorials favorable to the public utility companies. Similar work is being carried on in other States. Already the States of Kentucky, Indiana, Iowa, Nebraska and Michigan have similar committees who are operating in the same way through the members of their respective States. It is the plan of the National Electric Light Association to carry this work further along until the whole country is organized and committees operating in all the different States.

Although the work necessarily must be localized owing to the peculiar local conditions being different in different States—it will be supervised and directed from the headquarters of the National Electric Light Association by the Publicity Department, which we have already installed there.

During the past year the National Electric Light Association engaged Mr. Aylesworth, a gentleman who had been engaged in the public utility

business for many years, and in addition to that served as chairman of the Public Service Commission of Colorado for some two or three years. Mr. Aylesworth has been engaged as Executive Manager of the Association and gives all his time to the Association's work. He has full charge of all the work that is carried on from National Headquarters. It is Mr. Aylesworth's duty, and also his aim, to give from Headquarters a real service that has not been given in the past. That service was started some six months ago; first of all by engaging a Publicity Department to attend to the publicity side and then by engaging a man who does nothing but attend to the enquiries that come in from member companies with reference to their various problems. He takes them up, sifts them down, consults with the expert on such problems and sends back to the enquiring company the proper solution. In every way possible we are trying to make the National Electric Light Association a distinct help not only to the small companies but also to the large companies all through the States.

I am not here today to sell to you the National Electric Light Association of America; I am simply here to tell you about it. We are anxious to have you affiliated. We feel it will be to our advantage as well as to yours to have you affiliated with the Association. We feel that we can help you and we feel that the industry as a whole needs the co-operation of everybody connected with it in this Northern Hemisphere.

I think the Canadian Association should have its own individuality and I for one am strongly in favour of that, but I know it will find it advantageous to be a part of the organization and the technical, commercial and publicity work that we are planning to do in the United States. I think this is a matter that your Executive Committee have before them and it is one that they will have to settle for themselves. All I want to say is, I am sure the National Electric Light Association will meet the Canadian Association half way in any arrangement that may be proposed, and while I am not selling it to you I am here to give you a very cordial invitation to affiliate with us.

As you know, the National Association recently had its convention in Pasadena. The whole key-note of the convention was co-operation. We had there Mr. Edgerton, Chairman of the California Commission, and we also had Mr. Jackson, Chairman of the Wisconsin Commission. Both of those gentlemen spoke to the convention and their whole idea, as I remember their remarks, was the idea of co-operation between the regulating bodies, the public, and the industry itself in order that all the various problems that have come up or are coming up can be worked out satisfactorily to all. Personally, I feel that that co-operation is absolutely necessary. I think the public as a whole, whether they be in America or Canada or any where else, are fair if they thoroughly understand the situation, and we cannot accuse them of being unfair until we have told them and educated them up to what the situation really is. They are necessary to us and we are equally or more so necessary to them, and I feel sure that when they thoroughly understand the situation we shall have no trouble with reference to securing such a price for our product as will give us a fair return on the money that is invested and will enable us to take care of depreciation and the building up a surplus for contingencies that the business really needs. However, if we sit by and do not

do our part we should not complain at the way we are treated, because I think myself if you will look back over the experience of the American railroads, that one of the greatest mistakes they ever made was that they did not take the public into their confidence and explain to them the actual situation with reference to the railroads. I do not know whether you have ever thought about it but I think it is a good thing to think about. You know the ordinary business man cannot think along the line of public utility business. That is not his point of view. If he is a store keeper and has a full store, with lots of people in it, he knows that he has a fine business. If he is a manufacturer and has a factory full or orders he knows he has a good business and is going to make money. So naturally when he goes out and sees a street car loaded up he immediately thinks the street car is making a great deal of money because that is just along the line he thinks. He never thinks for one moment that whereas he may be turning his capital over ten times a year, a street car company is probably only turning theirs over once in five years. Interest does not mean anything to the ordinary store keeper. He does not have to think of interest, whereas interest is the great big item that we have to take care of. It is that sort of thing that has got to be taught the public, no matter whether it be in America or Canada. On the other hand we have got to give them good service, proper courtesy, do everything we can to make them our friends—appreciate that to a certain extent we are public servants and have got to put up with some of the things that public servants have to put up with, but in the long run I am firmly convinced that if we can at least instil into the public mind the fundamental economics of the electric light and power business we shall have no trouble in carrying our business on to a great success. (*Great applause.*)

Mr. D. H. McDougall:—It gives me great pleasure to move a vote of thanks to Mr. Insull for the great honour he has done in coming to us and giving us this very interesting and instructive address. I want to say I am sure it is your opinion, after what you have heard, that the National Electric Light Association is to be congratulated upon the appointment of Mr. Insull as their chief executive officer. (*Applause.*)

In 1916 I was successful in persuading the Nominating Committee of this Association to nominate me for President, and as such I became an ex-officio member of the National Electric Light Association Executive Committee. I profited so much from contact with the—to use a common expression, live wires and men of great experience that formed that committee, that when the next convention time came I was very industrious in pulling all the wires I could to get re-elected the second year, and I was successful in that. (*Laughter.*) So that the benefits I have received the first year were continued for another year, and I may say that those benefits were of great aid and great importance to the company I represent. The following year, however—although I had thought I had shown so much ability in the position of President of this Association, my wire pulling was no good and Mr. Grier was appointed and succeeded me. But in the interval, owing to the fact that America had come into the war and was anxious to co-operate and learn about Canada's war efforts and had a great appreciation of the work that Canada had done, the President of the National Association asked me to

read a paper on the "Treatment of crippled soldiers and re-establishment into civilian life of men wounded at the front." I do not know whether or not it was owing to that, but they had great sympathy at that time for us, but they did me the great honour at that time, as I was the Canadian representative on their Board, of electing me as Executive Committee member for a term of three years. The second year is about to start.

Now, I can assure you gentlemen that, not only has this National Association been a benefit to me, and to my company, but it has been a benefit to every company who sent men to take a position on any of the National committees. One man at one of those committee meetings stated that they had a very large programme of construction and they had hard work to spare their engineer to go to a meeting in New York in connection with Electrical Apparatus Committee—I am not sure exactly what it was—one of the technical committees. This engineer went to New York; he talked over his problems with the individuals of that committee who represented very large companies and men of great experience, and visited one or two plants, and when he came back, as a result of that visit, the expenditure of that company was curtailed by some $200,000 just from the ideas he had picked up on that journey.

The Association can only benefit to the extent that they are willing to co-operate and co-operation means sending their men to these committees and allowing the National Association to get the benefit of our experience and at the same time reaping the benefit of theirs. It especially affords me pleasure in being able to testify to these benefits.

I may say we have had, as you probably are aware, a great deal of litigation, labour trouble and disputes with government ownership in Ontario, and the National Association has been of material advantage to me on various occasions in connection with those disputes. On one occasion I practically absorbed the time of three or four of their experts in the New York office for the best part of a week, not only in the day time but at night in working on a problem in connection with the service rendered by my company under orders of the Power Controller in Canada. The material worked up there was accepted and afterwards used in the Exchequer Court in a very important case involving a claim of over a million dollars. I was just going to overlook that but I think that should be known and the benefit that the N.E.L.A. conferred on my company, and indirectly to the association here, should be mentioned.

I have very much pleasure in moving a hearty vote of thanks to Mr. Insull for his trouble in coming here and to the National Electric Light Association for sending him. (*Applause.*)

MR. DION:—It affords me a great deal of pleasure indeed to second the resolution of thanks to Mr. Insull, who has so kindly left his business to come and honour us and give us the privilege of hearing the words of wisdom which he has uttered. I feel deeply the benefits that can be derived by members of the Canadian Electrical Association from the National Electric Light Association if we only take advantage of the benefits that are offered.

It is quite true that being under different political allegiance some of our problems are different from those of the United States—to some extent, and

that it is impossible for the National Electric Light Association to give us the same assistance that they are able to give to their American companies. Leaving that aside, there is still a great deal of assistance that they can give us if we will only take advantage of it.

Mr. McDougall has told you of the benefits that he has received for his company. He would not have received those benefits if he had not gone after them. I wish to say if we have not as members of the Canadian Electrical Association got as much as we might have got from the National Electric Light Association, it is largely our own fault. They will give us the assistance if we go after it, and my regret is that we have not done so to sufficient extent If we had we would have appreciated perhaps more than we do now what they can do for us.

My advice is that under the re-organized society which we have been told about, the re-organization which makes the society still more useful, we should take advantage of it to a greater extent. We should go to it with all our problems, small or large. It is to be expected that an organization as large and influential as it is, has under its finger ends a mass of information and advice which can be useful to us.

Again I wish to thank Mr. Insull for his great kindness in coming to us. (*Applause.*)

The President:—A certain proposition has been moved and seconded. I am going to deal with the matter a little informally, if I may add some words of my own.

There are one or two personal things I wish to allude to. With respect to Mr. McDougall, he can say such preposterous things seriously that those who do not know him well, might think there is an atom of truth in his remarks. He was elected not only once but twice, not from efforts on his own behalf but despite the objection on his own behalf which would really have kept him from accepting such a position, if it had not been so voluntarily tendered to him by his fellow members of the Association. I know that to those years he might very well have added another, but for the circumstance that he suggested to the Association they should make a change from him to the unworthy holder of the title at the present moment.

Now, as to the speaker of this afternoon, I should like in the first place to suggest to him that he never again allude to facility of speech on my part and deny any such quality to himself. Will he permit me to give myself the honour of associating myself with him. I feel that he is an exemplification of that thing which is said to be the highest art, that is the art of concealing art. Occasionally, you know, men speak with such ease that you are hardly conscious of the fact that things are being done, because the accomplishing of them is so easily and quietly done. And that is the case of the speaker this afternoon who, in such delightful, terse and lucid manner, has set forth some of the benefits of the National Electric Light Association. While he had opportunity in the short time which he allotted to himself—we would have given him many minutes longer—we feel and know that there are advantages in addition to those which he allowed himself to deal with in speaking to us. I can assure him that we are very well aware of the fine work of the N.E.L.A. and I can assure him also that we deeply appreciate the honour of being

associated with it, and not only that, but also the advantage of being affiliated with it. And if I can forecast at all what is likely to happen in the immediate future of this Association, I venture to say there will be no serious effort whatever to dissociate ourselves from the N.E.L.A., but, rather to bind ourselves more closely with it, if possible, than before.

May I say, in refutation of his suggestion of lack of facility in speaking, that as he spoke he reminded me of lines which are very favourite ones of mine from Tennyson, and which I would like to give you, if, for no other reason, or because I think there is contained a splendid admonition as to how works should be done:

"He wrought all service with a noble ease
That graced the lowliest act in doing it."

I am not suggesting that in addressing the Canadian Electrical Association it was the lowliest possible action on the part of the President-elect of the N.E.L.A., but, it was as compared with addressing his own Association a comparatively small matter so far at least, as members attending have been concerned, but in a liberal sense it has been quite large because it has been the address of not only one individual to another but of one nation to another—nations which, in my judgment, must be allied.

It is with peculiar satisfaction this afternoon that we welcome one who not only represents the nation of America, but, originally, as he states, was himself a journeyer from the Old Land. He, I am sure, will agree with me, and you all will agree with me in this, that the fate of the world would be a sorry one indeed, if at any time there should be any real division between the two great English speaking divisions of the human race.

Sir, it is in this spirit and from a full heart that I tender to you our heartiest thanks for your address this afternoon.

MR. INSULL:—Mr. President and gentlemen, I very much appreciate the reception that you have given me here. I enjoyed myself immensely last evening at your dinner and later on at your dance, and shall ever remember the pleasure it has given me to be present here.

THE PRESIDENT:—We now have the pleasure of listening to a paper by Mr. Colville on the subject "The New Viewpoint on Modern Lighting," which will be illustrated by slides, and I shall be glad if Mr. Doddridge will occupy the Chair during that paper.

Mr. Doddridge takes the Chair.

MR. J. R. COLVILLE:—Mr. Chairman and gentlemen, the subject on which I am scheduled to speak this afternoon is, as you know, "The New Viewpoint on Modern Lighting," and I wish to say at the outset that I am not going to bore you with any dry details of lamp manufacture or with details of illumination design, important as these are.

THE NEW VIEWPOINT ON MODERN LIGHTING

By J. C. COLVILLE

Abstract of the Paper presented.

The author stated that in the United States there was an unmistakable change in the attitude of central station, lamp and reflector manufacturer, and consumer toward illumination. This change in attitude has been sensed for some time and in the past few months evidence has been accumulating so rapidly as to leave no doubt that a new era in lighting is at hand.

It was pointed out that while remarkable strides have been made in the development of lighting equipment, the proper application of new developments has lagged somewhat behind. The history of lighting practice has in a broad sense been one of substitution:—substituting carbon lamps for gas, tantalum or gem lamps for carbon, Mazda B lamps in turn for these, and finally, in many cases, substituting Mazda C lamps for Mazda B. The use of these higher powered illuminants in place of lower powered ones has not been accompanied with the necessary steps to safeguard the stronger illuminant against glare, with the result that the opinion that an interior was supplied with "too much light" was often expressed, whereas the truth was that there was too little light but "too much glare".

The excellent work of illuminating engineers in promoting really good illumination, in developing equipment that would permit the use of high powered sources without glare, in reducing to a science the things that happen between the time the light leaves the lamp as lumens and the time it registers its impression on the eye, was briefly discussed.

Data prepared by Mr. Ward Harrison, which showed that with modern illuminants it was possible to illuminate industrial plants artificially in accordance with daylight lighting standards, was presented. Tests, conducted by one of the large central stations in the United States on production results under high standards of illumination, were discussed and it was pointed out that increases in operating expense brought about by good lighting—increases ranging from 9/10 to 5-5/10 per cent. of the pay-roll of the plants—were accompanied by increases in production as recorded both by plant officials and the testing engineers, ranging from 10 to 35 per cent.

Several examples were cited of industrial plants where improvements in the illumination and the use of light in quantities greatly in excess of those considered practicable only two or three years ago had produced results which were extremely gratifying to the industrial executives. The part light plays in accident prevention was mentioned.

The foot-candle meter, an instrument which takes the guess work out of lighting, was discussed at some length and its application shown. This instrument permits illumination to be measured as readily as a thermometer permits the measure of temperature. It has made lighting something tangible, something definite, something whose effects can be studied quantitatively by the man who pays the bills.

The importance of approaching customers through the medium of a lighting demonstration was emphasized. It was pointed out that no one can

think intelligently with regard to the lighting of his plant unless he has seen a well-designed system in operation. He must have something to serve as a criterion, something upon which to base his imagination. Many industrial plant officials are thoroughly convinced of the importance of proper lighting and believe that their plants are well lighted when inspection of the plants will show that their lighting is far from adequate as judged by modern standards. Reference was made to the booklet "Seeing is Believing," published by the Lighting Sales Bureau of the National Electric Light Association, and it was urged that all interested obtain copies of this booklet and take the time to read it. It explains the reasons for the effectiveness of the lighting demonstration and gives data which simplify the installation of a demonstration room.

In conclusion the author showed a number of slides of industrial lighting where the illumination ranged in general between ten and twenty foot-candles and where the results obtained have been extremely satisfactory to the plant managers.

ILLUSTRATIONS

Fig. 22:—The Foot-Candle Meter, an instrument which permits illuminating readings to be quickly and easily taken at the work. It measures light much as a thermometer measures temperature. It is particularly useful in gauging lighting requirements and in checking the maintenance of a lighting system.

Figs. 23 and 24:—The same interior before and after the lighting specialist has done his work. It is transformations of this kind which are making industrial executives strong advocates of real illumination.

Fig. 25:—This armature-winding room is an instance where within a period of a year the plant management found it profitable to increase the illumination by three successive steps from 5 foot-candles to 17 foot-candles. It was felt that the cost of light was negligible compared with the total cost of production.

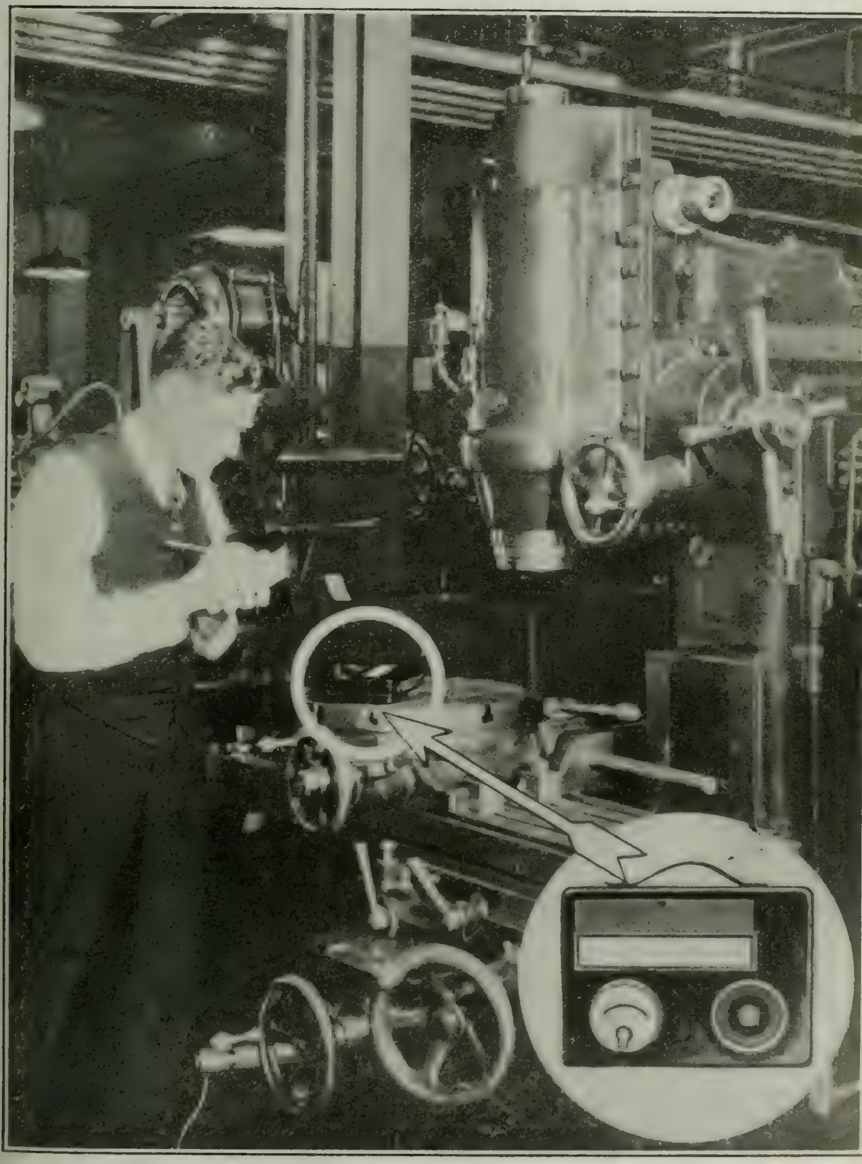
THE CHAIRMAN:—Are there any gentlemen present who would like to contribute something to the discussion of this most interesting paper?

THE PRESIDENT:—Having the pleasure of listening to the paper this morning and the paper this afternoon, I should like to give my individual testimony to the extreme interest and extreme worth of both of the papers. They were tremendously interesting to all who had the pleasure of listening to them, and I should like to voice my great appreciation on behalf of the Association of the kindness of the gentlemen giving these excellent papers.

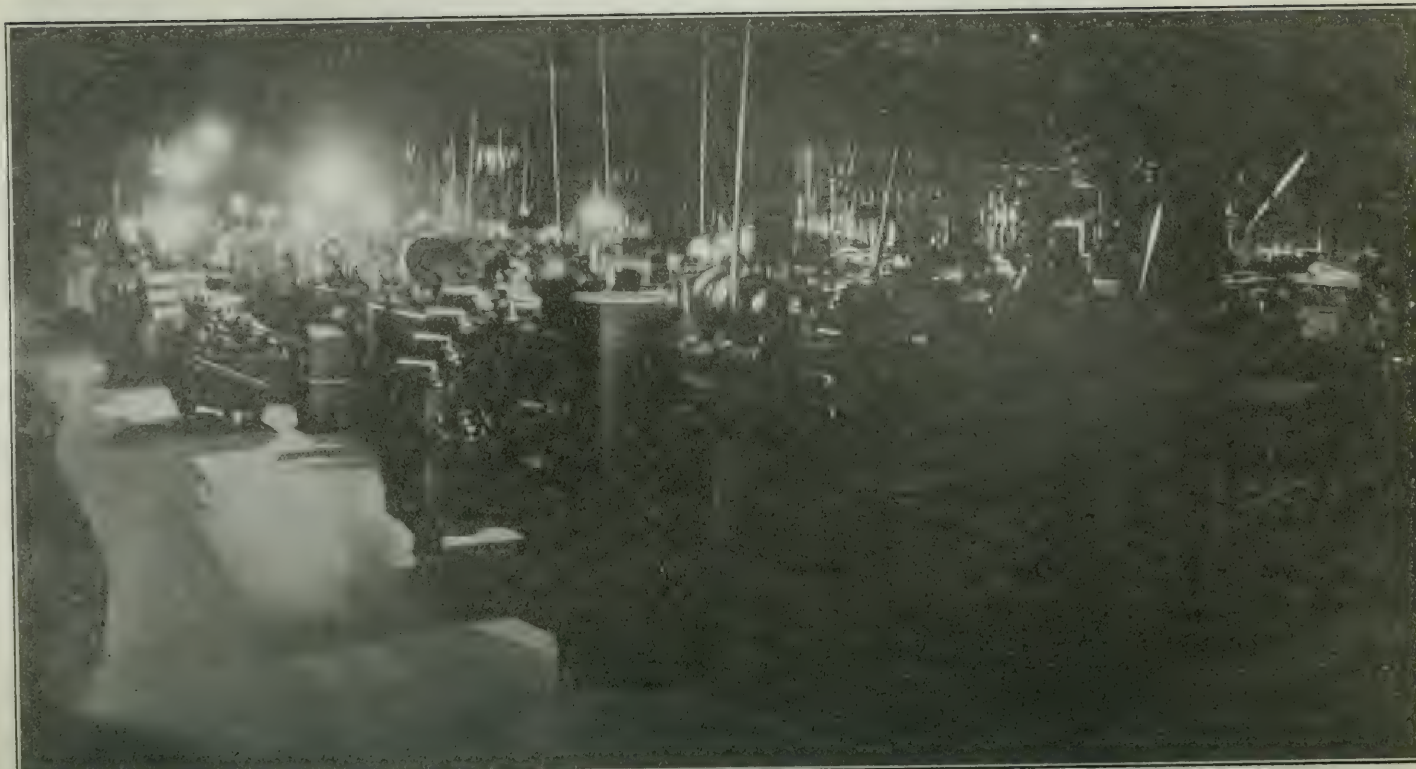
MR. MACLACHLAN:—Just one point I would like to draw out, in all these pictures we have seen of improved illumination it is noticed that there is not one sub-station or power house. Would not it be possibly well for the public utilities to illuminate their own properties adequately, possibly a little more than adequately, from an advertising standpoint alone. I know what it would do to improve the accident record of those public utilities, having possibly been in every power house and sub-station in Ontario and some in Quebec. I think there are a good many passages that could be better illumi-

nated, and then you could take your possible customer in and show him good illumination.

MR. COLVILLE:—I did not do more than touch on the subject of accidents. I suppose you are familiar with the fact that statistics gathered by

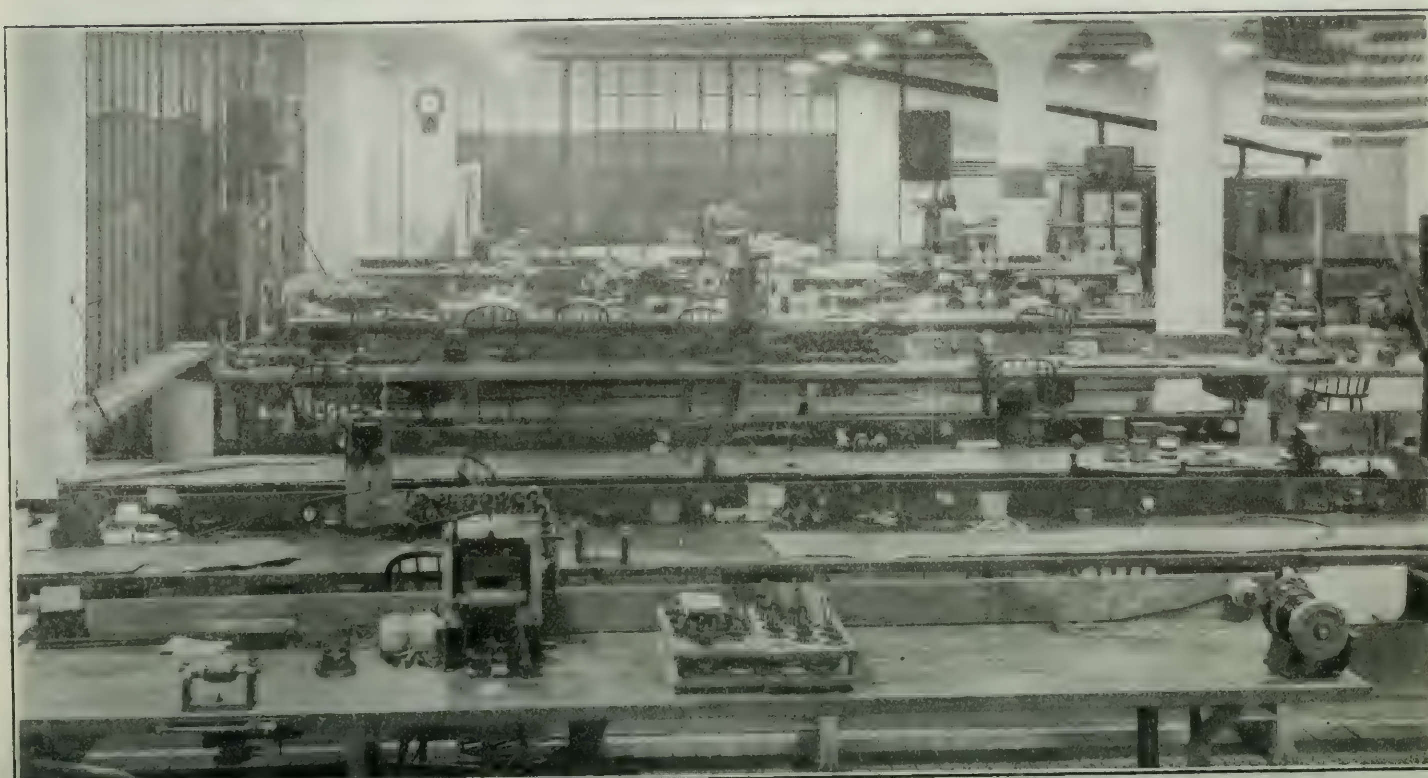


(Fig. 22)



(Fig 23.)

(Fig, 24)



(Fig. 25)

insurance companies, which I think we are all willing to admit are uncanny in their accuracy, show that of 91,000 industrial accidents investigated in 1910, 24 8/10% were due to either improper or inadequate illumination. There has been some change since then because illumination has been progressing in the meantime. I believe I am correct in saying a great deal of progress has been made in the last 6 or 8 months. The big improvement seems to have happened in the last six or eight months because it is since then that the manufacturers have taken matters more or less in their own hands.

This figure of 24.8% is impressive, but I like to think of it in this way: Whenever you meet a person who has been injured in a factory, it is just one chance in four that illumination was at fault in causing that injury.

MR. GEO. K. McDOUGALL:—Mr. Chairman, as Mr. Grier says we are very much indebted to Mr. Colville for this paper and for the lantern slides. I have been working along these lines and I can bear him out in saying it is almost impossible to put in a lighting installation that is too good. I think that in all the cases I have had anything to do with, I was always sorry afterwards I did not figure the illumination about one hundred per cent. greater. It is a very difficult thing to start the ball rolling and there is a great deal of missionary work required to convince shop management that there is a great deal in illumination. They will all admit that there is a lot in it, but to get them to actually move is a different story. In most shops the equipment that has been put in is of such a cheap character, such as tin shades, and other inferior material, that after a month or so of use the workman finds it is absorbing so much light that he takes the shade off. The result is he very soon thinks the lamp is not big enough and he gets a bigger one, and the result is that he cannot see at all, as the light he is getting is all glare.

The great trouble in this country is that there is too much individual lighting used. The great fault of individual lighting is the contrasts produced. The eye, as a protection, adapts itself to the brightest field in view, with the result that a bright lamp in the field of vision causes the aperture of the eye to close down and prevents him from seeing his work properly.

There are a great many people that do not realize that illumination can be calculated. It is an engineering subject but there are not enough trained men that are interested in it. The layman realizes that he ought to have better lighting but he does not know how to go about it. Salesmen are too apt to sell efficient fixtures, not efficient lighting. Efficient fixtures in one case may be very inferior fixtures for another class of work. To be able to advise people, salesmen ought to be educated to know what type of fixture is required for a certain type of work. For instance, a good lighting fixture may be entirely out of place in a machine shop, as the lighting might be so diffused that form could not be recognized properly.

I have had numerous talks with public utility managers and others in regard to this question and find it hard to move them. They think that the business is coming in and the lighting fixture salesman is educating the public to better lighting, but as a rule, he is not. He may sell them expensive equipment and has really given them no advantage over otehr equipment. I think it is up to the public utilities to do the educational work. If they do it will well repay them.

As Mr. Colville has remarked, the intensities have gone up four and five times. This means that the sale of current for lighting would be increased in proportion and this is usually one of the divisions of load that operates on higher rates. In most manufacturing plants the load factor on the lighting equipment is fairly high as the equipment runs a good deal of the time. There are very few factories that are not using a great deal of artificial light. In fact I think about 25 per cent., if I am not mistaken, of our total working time is put in under artificial lighting conditions.

MR. COLVILLE:—Out of a survey of about 500 industrial plants in the United States, chiefly in the industrial sections, we learned the surprising fact that less than ten per cent. of those plants would come to the central station for information on lighting. The majority of them would go to some fixture dealer. Now, the central station is the one that has its customer's business most closely at heart and is the one in most intimate touch with buyers of lighting and it should certainly be in a position to give the kind of information that the customer wants. This lighting demonstration—I do not want to harp unduly on that subject—this lighting demonstration gives opportunity for the central station to gather in the fixture men and show them what is what, and gives the central station men a chance definitely, to take the leadership on illumination and makes for co-operation and the selling of the kind of fixtures best suited for the work.

I want to say also that the N.E.L.A. is preparing a handbook. One of the sections of it deals with industrial lighting and this subject, will, I believe, be very well covered in that handbook.

THE CHAIRMAN:—Any further discussion? If not, I want to say that it gives me a great deal of pleasure to convey to Mr. Colville the thanks and appreciation of this Association for his very interesting address. It is a subject which is of very considerable importance to the members of the Canadian Electrical Association. I think in the past, and a great many of us in the present as well, we have thought too much of selling our product as light instead of selling it as illumination.

While I am on my feet I would like to thank the General Electric Company of the United States for sparing Mr. Colville to come here and address us. I would ask him to convey our thanks to his company for that favor.

Mr. Grier takes the Chair.

THE PRESIDENT:—That closes what, I am sure you all agree with me, has been a very delightful afternoon and also closes the open meeting of the Convention.

PROCEEDINGS OF

ANNUAL CONVENTION

31st Year

Canadian Electrical Association

HELD AT QUEBEC CITY, QUE.

JUNE 15-16 and 17, 1921

Office of the Association

601 POWER BUILDING

MONTREAL, QUE.

WE respectfully suggest that our members take SPECIAL NOTICE of the Advertisements distributed amongst the papers and discussions and bear them in mind when in need of materials.

CONTENTS

INDEX TO ADVERTISEMENTS

CANADIAN ELECTRICAL ASSOCIATION

OFFICERS, 1921-1922

President:
JULIAN C. SMITH
The Shawinigan Water & Power Co. POWER BLDG., MONTREAL, QUE.
1st Vice-President:
P. T. DAVIES,
Southern Canada Power Co., Montreal, Que.
2nd Vice-President
A. P. DODDRIDGE
Quebec Rly., Light, Heat & Power Co.. Quebec City, Que.
3rd Vice-President
L. W. PRATT
Hamilton Cataract Light & Traction Co., Hamilton, Ont.
Secretary-Treasurer:
EUGENE VINET
The Shawinigan Water & Power Co., Power Bldg., Montreal, Que.

ADVISORY COMMITTEE

COMPOSED OF PAST PRESIDENTS ELIGIBLE FOR OFFICE.

EXECUTIVE COMMITTEE

CHAS. T. BARNES,
The Toronto & Niagara Power Co.
R. J. BEAUMONT,
The Shawinigan Water & Power Co.
N. S. BRADEN,
Canadian Westinghouse Co.; Hamilton, Ont.
A. A. DION,
The Ottawa Electric Co.
A. MONRO GRIER. K. C.
Canadian Niagara Power Co., Niagara Falls, Ont.
D. H. MCDOUGALL,
The Toronto Power Co.
J. S. NORRIS,
Montreal Light, Heat & Power Consolidated.
M. K. PIKE
Northern Electric Co., Montreal, Que.
J. W. PILCHER.
Canadian General Electric Co., Montreal, Que.
D. H. ROSS.
Sangamo Elec. Co. of Can. Ltd. Montreal, Que.
W. L. WESTON,
NOVA SCOTIA TRAM. & POWER CO. HALIFAX, N. S.
J. B. WOODYATT,
Southern Canada Power Co.
THE PRESIDENT,
National Electric Light Association, N. Y.

PROCEEDINGS

The Thirty-first Annual Convention of the Canadian Electrical Association was held in the City of Quebec at the Chateau Frontenac on the 15th, 16th and 17th of June, 1921.

In spite of the distance to be travelled by most of the delegates, the attendance was quite a large one, there being also many ladies accompanying the delegates.

Amongst some of the prominent men in the electrical industry who attended the Convention could be mentioned:

Milan R. Bump, Pres. of the National Electric Light Association, New York.

W. H. Onken, Jr., Editor of the Electrical World, New York.

W. L. Goodwin, Gen. Manager of the Society for Electrical Development. Inc., New York.

K. B. Thornton, Pres. Electrical Co-operative Association for the Prov. of Quebec, Montreal.

Samuel L. Chase, Westinghouse Company, New York.

Dr. Walter Carr, Editor, Electrical News, Toronto

and several others.

The Convention was pronounced as having been a most successful gathering. This was largely due to the masterly way in which it was handled by President A. Monro Grier, besides the untiring efforts of the Local Reception Committee, headed by Mr. A. P. Doddridge, and also the kindness of the Local Companies—not to mention the fact that the old historic city of Quebec has a charm of its own.

OPENING SESSION.

WEDNESDAY, JUNE 15th.

President A. Monro Grier in the chair.

THE PRESIDENT:—Gentlemen, I regret to say that we shall not have the honour of hearing from Sir Charles Fitzpatrick this morning. To me individually this is a great disappointment, because I have had the pleasure of watching his career, in which he has gone from greatness to greatness, first as a successful lawyer, then successful legislator, later as successful Minister of the Crown, then a success as judge, being head of the Judicial System in Canada, and now Lieutenant-Governor of the Province of Quebec. It is a career of very great interest, and of course of notably great interest to us who come from Ontario to Quebec. Whilst we have not the pleasure of listening to Sir Charles Fitzpatrick, we are to have the very great pleasure of listening to the Mayor of the City of Quebec.

There is a charm to us of Ontario in coming into the Province of Quebec, as well as to the City of Quebec, in that it gives us (those of us who are of right mind) the opportunity of expressing to those in Quebec, our

very great appreciation of that wonderful Province. If there are those who fail to appreciate the qualities of the artizans of the Province of Quebec, certainly those who so fail are not to be found in the ranks of the Canadian Electrical Association.

Mr. Mayor, it is with a sense of the worth of those things which we represent, that we welcome you to ourselves, as one who is, I understand, to give us a welcome to your splendid City of Quebec.

MR. J. SAMSON, MAYOR OF THE CITY OF QUEBEC:—

Monsieur le Président, Messieurs les Officiers et Membres de la Canadian Electrical Association:

Monsieur le Président, Messieurs:

Les citoyens de Québec apprécient hautement l'honneur que vous leur faites en choisissant Québec comme siège de votre trente-et-unième convention annuelle, et je viens, aujourd'hui, comme Maire de Québec, vous souhaiter la plus cordiale bienvenue.

Nous avons toujours le désir de grouper en notre ville le plus grand nombre possible de représentants des puissantes sociétés scientifiques ou commerciales. D'abord, parceque notre ville a toujours été, depuis sa fondation, en 1608, un centre intellectuel des plus actifs, et ensuite, parceque la Providence a répandu sur la ville et ses alentours les plus grands avantages, de nature à attirer la bienveillante attention des hommes d'affaires.

Nous sommes situés géographiquement au centre de l'activité commerciale et industrielle. Notre port est magnifique et si bien préparé par la nature, qu'il reste très peu à faire par la main d'oeuvre pour qu'il se transforme aussitôt en l'un des plus beaux et des plus sûrs du monde entier. Notre climat est sain. Nous avons abondance d'air pur, d'eau potable, des ressources illimitées en bois et en mines. Notre peuple est intelligent, travaillant, trés apte à devenir expert en toutes les branches de l'industrie, consciencieux et respectueux des lois, et presqu'entièrement oublieux des querelles et des troubles ouvriers.

Et si nous considérons maintenant, les intérêts commerciaux de votre Association, nous pourrions ajouter que nous possédons autour de la ville des sources illimitées d'énergie et de pouvoir électrique, qui pourraient faire de Québec l'un des plus grands centres de l'industrie électrique.

Je vous engage fortement à visiter nos champs de batailles historiques et nos lieux célèbres, sans surtout oublier de considérer attentivement les avantages qui vous sont ouverts dans le domaine commerciale et industriel.

En voyant l'énorme quantité d'énergie électrique dont nous disposons, et que nous avons encore augmentée et dévelopée par notre travail, vous serez aussitôt convaincus du brillant avenir qui nous est offert, à condition que nous puissions faire usage de toutes nos ressources.

Monsieur le Président, Messieurs, Avant de terminer, je réitère encore une fois mes souhaits et j'espère dans notre ville vous sera des plus agréables et que, comme pour les conventions précédentes, vous obtiendrez un plein succès de vos importantes délibérations.

Mr. Chairman, Gentlemen Officers and Members of the Canadian Electrical Association in Convention at Quebec,

Mr. Chairman, Gentlemen:—The citizens of Quebec appreciate the honor which you have conferred upon their City by selecting it as the seat of your

thirty-first annual Convention, and I am here, as Mayor of Quebec, to tender you the most cordial welcome.

We are anxious to secure as many as possible of these important social gatherings as are afforded by Conventions of scientific or of business men. First, because our City has always been since its foundation in 1608 an active intellectual centre, and also because Providence has bestowed on Quebec and surroundings most precious advantages which claim the attention of the business world.

Our site geographically speaking is a most desirable centre for commercial and industrial activities. Our Harbour is magnificent, and so well prepared by nature that it needs but few artificial improvements to make it one of the very finest and surest in the world. Our climate is healthy. We have pure air, abundance of water, unlimited resources in timber and mines. Our population is intelligent, hardworking, easily becoming expert in all lines, conscientious and respectful of law, and almost entirely free from labor disputes.

Now, if we consider the special lines of the business of your Association, we may add that we have around Quebec unlimited resources in electrical energy and power, which could make of our City one of the most valuable centres of electrical activities.

I entreat you to visit our City, to not only admire our venerable landmarks and historic associations, but also to appreciate our facilities in offering you commercial and industrial enterprises. An examination of the amount of electrical energy which may be establisned and developed in Quebec, will, I hope, convince you of the great future reserved to our City, if we can use all our possibilities.

Mr. Chairman, Gentlemen, I wish you a pleasant stay in our midst, and we all hope that, like all the preceding ones, this Convention will be a great success. (Applause.)

THE PRESIDENT:—Gentlemen, we have listened with very great interest to this address to us from the Mayor of the City, who has been kind enough to give it in both French and English form. I should like, in passing, to point out that in the Provinces, other than the Province of Quebec, it would be very difficult, if not impossible, to get any Mayor to give an address in both French and English, which would be acceptable to the people of both languages. This has been done for us by the Mayor this morning, and therefore we appreciate not only the kind sentiment as well as the very acute commercial and other observances which he has made, but also the manner in which the remarks have been extended to us.

On behalf of the Association, Mr. Mayor, I thank you very much indeed for your cordial reception of us here, and we can assure you that we shall do our very utmost to get a further knowledge, while here, of some of the wonderful social as well as æsthetic charms and beauties of Quebec.

Let us respond by a hearty vote of thanks to the Mayor for his delightful address. (Applause.)

THE MAYOR:—I thank you very much, and trust you will enjoy your stay here.

THE PRESIDENT:—It is quite the usual thing for the President to make some remarks at the beginning of the Convention. As you are aware, I

have not always done so, and I am not doing so this morning. I do wish to say this however. You have all been exceedingly kind and tolerant to me as President of this Association, and it would be a bit of insincerity on my part to suggest that it does not mean anything on your part towards me. I believe the expressions of good will and kindness have been quite sincerely and faithfully uttered. I should like to say, that if that has been, and I believe it has been the case with yourselves, most decidedly, it has been so in my case. In that spirit then I meet you all, and I recognise that you meet me in just the same spirit.

My own feelings about this Convention are that it is going to be an exceedingly enjoyable one, and I think if we pay attention to the papers which are going to be read, and if those who know anything about the papers will discuss them, we shall get a considerable amount of useful help from the Convention. The Convention should not be a matter of enjoyment only, nor should it be all work, but there is no reason why we should not work well while at work and play well while at play.

If by any chance any reader of a paper finds that to read it in full would mean that he would substantially overlap his time, I shall trust to him to see that by the shortening of his paper, he keeps within his time, because the papers are printed and copies will be circulated later.

The first item is the report by the Secretary-Treasurer. I am not going to take up your time now by reference to the qualities he has displayed. It is sufficient to say in passing that during the course of the year we have had the finest and most efficient service rendered by the Secretary.

REPORT OF SECRETARY-TREASURER, 1920-1921

Mr. President and Members:—The year coming to an end has been one during which several changes have taken place within the Association. The headquarters were moved to Montreal, this being the natural outcome of the situation in the power business. The re-organization of the Sections and Committees has been effected so as to fit in with those of the N. E. L. A., and we now have a Technical Section with four standing committees, namely:

Meter Committee.
Electrical Apparatus Committee.
Overhead Systems Committee.
Hydraulic Power Committee.

The Commercial Section has four Bureaus, as follows:—

Power Sales.
Lighting Sales.
Merchandise Sales.
Salesmen's Education.

The Accounting Section and the Public Relations Section.

Besides the above we also have an Accident Prevention Committee and a Membership Committee. There have been, during the year, one or two temporary committees formed for looking into questions of the moment.

The chairman of each of the standing Sections and Committees is a

member of the same national Section or Committee of the N. E. L. A. so that, by this means, a contact is established between all the people interested in any one subject in the whole of the North American continent ,and the very latest information at all times is available to the members. Undoubtedly after another year of this system the various committees will work to even greater advantage than they have during the first trial year and greater benefits will be derived. It is well to remember, however, that these results can only be obtained through the co-operation and efforts of the various committeemen, and it is of the greatest importance that meetings be well attended even if lengthy journeys are necessary.

The Executive Committee have had four meetings during the year which were well attended and a good deal of important business was handled. Your Secretary attended two of the Executive Meetings of the N. E. L. A. and the Chicago Convention.

In the course of the last ten months special efforts have been made by the membership committee to increase the number of members of the Association with very gratifying results as will be stated in the report of the Membership Committee.

Amongst the main activities of the Association during the past year should be mentioned the formation of the St. Maurice Valley Section of the C. E. A. This was formed for the benefit of the members located at Grand'Mere, Shawinigan Falls, Three Rivers and ultimately La Tuque. Several meetings have been held at which very interesting papers were presented. This new Section has now a membership of approximately seventy-five, and its formation has been successful enough to suggest the formation of similar sections at other centres in Canada where a sufficient number of members are grouped together. The Toronto Section has been in existence for a number of years and has also proved of continued interest to the members.

While on this subject of sections, it might be of interest to mention that your Secretary has been corresponding with members in the Maritime Provinces and Western Canada with a view to the formation of Geographic Divisions which would offer a better means to far distant members of having their own gatherings and committees, and make the Association of greater value to them on a plan similar to that of the N. E. L. A. However, it seems that until such time as a representative, or someone truly interested in the affairs of the Association takes upon himself the duty of making a personal canvas of the bigger companies in such localities, that little can be accomplished, as corresponding is a comparatively unconvincing way of placing before them the many advantages to be derived from the Association and the formation of such Divisions.

Although to-day practically all of the most important central station companies and electrical manufacturers are members, the membership should certainly be greater and have a larger representation of companies in the far Provinces in order to make the Association truly representative of the industry in Canada, and it behoves us all to take a greater interest in its expansion by enlisting new members whenever possible, as the larger the organization becomes the greater service it can be to one and all of its members.

Another matter of general interest to the electrical fraternity in Canada is the medal offered by the Association for successful cases of resuscitation by the Prone Pressure Method, details of which will be given in the report of the Accident Prevention Committee.

The Proceedings were printed as in the past, and sent out to all members. They consisted of 150 pages of printed matter as against 135 the previous year. As most of you have noticed this year, advertisements were secured to partly defray the cost of the printing, besides being of decided advantage to those wishing to avail themselves of the opportunity of placing their name before the members of the Association.

During the year four circular letters and four questionnaires were sent out to Class "A" and Class "D" members besides nearly three hundred letters for soliciting new members. Including the above, with the regular routine correspondence, nearly two thousand letters were sent out from the office of the Secretary.

The finances of the Association can be considered as satisfactory when everything is taken into account. The receipts have been higher than previous years, owing largely to the scale of dues paid by the member companies of various classes. Expenditures were also higher than previously, due to various causes such as moving, higher cost of printing and stationery, greater office expenses through larger activities and a few other items as shown in the accompanying statement. It is pleasant to state, however, that in spite of the heavy expenditure the net balance is higher than in any other year in the history of the Association.

Of the dues collected for membership 50% is paid to the N. E. L. A., and it would seem desirable that the members, being aware of the fact that half their dues are paid to the bigger Association, should take full advantage of all the privileges of the latter and avail themselves of the various classes of literature and information which are always available on demand to members at large.

It was your Secretary's privilege in the course of the past few months to be in touch with a good many people in our line of business both in Canada and the United States. In view of this fact it might be permissible as this report nears its end to express one's opinion as to existing conditions and what might be expected.

While it would be shortsighted to ignore the present state of business depression which exists everywhere as a consequence of the after effects of the great war with the many readjustments which are now taking place and are yet to take place, if the present inflated value of money is to be brought down to its proper standard, we nevertheless, engaged as we are in one of the basic and fundamental industries of our times, must necessarily push forward on sound economic lines if we are to fulfil the requirements of our growing country, and there is no reason why we should not believe that once the present clouds have cleared away the Power and Electrical business in general in Canada is bound to reach a scale not experienced in the past, as it will then undoubtedly go forward by leaps and bounds.

It was mentioned at the Chicago Convention two weeks ago that $5,000,000,000 would be required within the next five years to take care of the demands on the electrical industry in the United States, if the people were to be properly supplied with all the requirements of modern comfort and living, and while in Canada the figures cannot be on such a stupendous scale as

our population is not large enough, yet in view of this country being more intensively electrified per capita, we can expect that future expansion of our business will also reach very high figures.

As a closing word to this annual report your Secretary wishes to thank all the members of the Executive and of the Association in general for their hearty support and co-operation in his work during the past year.

Respectfully submitted,

EUGENE VINET, *Secretary-Treasurer.*

PROFIT AND LOSS STATEMENT FOR TWELVE MONTHS ENDING MAY 31, 1921.

BALANCES AS AT JUNE 1920.			
Cash in Bank	$3,562.19		
Cash on Hand	22.80		
Victory Bonds maturing 1933	700.00		
		$4,284.99	
RECEIPTS FOR YEAR.			
Membership dues class A. fixed	1,510.00		
percentage	3,440.61		
" " " B.	619.00		
" " " C.	115.00		
" " " D.	1,230.00		
" " " E.	54.00		
" " " F.	195.00		
" " " G.	90.00		
Income from Advertisements in Proceedings	840.00		
Interest on Victory Bonds	38.50		
Miscellaneous Income	248.01	$8,380.12	
			$12,665.11
DISBURSEMENTS.			
N. E. L. A. 50% of dues 1919-1920	$ 397.44		
1920-1921 up to date	3,592.82		
Sundries (Handbooks)	17.00		
Honorarium Secty.-Treas. 1920	1,000.00		
Proceedings	1,093.85		
Other Printing & Stationary	382.98		
Convention & Travelling Expenses	279.16		
Gen. Office Expense	335.00		
Auditing for 1920	40.00		
Exchange on cheques	5.67	$7,143.92	
BALANCES AS AT MAY 31/21.			
Cash in Bank	4,787.22		
Cash on Hand	33.97		
Victory Bond maturing 1933	700.00	$5,521.19	
			$12,665.11

Audited and Certified
correct as per Report.
W. A. STITT, *Auditor.*

Certified Correct
EUGENE VINET, *Secretary-Treasurer.*

MONTREAL, JUNE 10th, 1921.

To the President and Executive of the Canadian Electrical Association.

DEAR SIRS:—I beg to report having audited the books and accounts of your Association for the year ending May 31st, 1921, and attach hereto the above statement:

"Profit and Loss Account."

Satisfactory receipts have been produced covering disbursements and cash in bank and on hand, and securities held have been verified.

I have received all explanations and information I have required and hereby certify that subject to the above report, the attached Profit and Loss Account is properly drawn up so as to represent a true and correct view of the financial position of the Canadian Electrical Association, according to the best of our information, explanations given to us and as shown by the books of the Association.

Respectfully submitted,

W. A. STITT, *Auditor.*

THE SECRETARY:—I beg to move the adoption of these reports.

THE PRESIDENT:—Will some gentleman second it? Seconded by Mr. Doddridge.

It has been moved and seconded that this interesting report of the Secretary-Treasurer be adopted. Shall I put it forthwith to the meeting, or do you wish to discuss it in any way? Carried unanimously.

Before passing to the next item, I should like to express my individual appreciation of the report of the Secretary-Treasurer. Reports as a rule regarding facts and figures are rather boring, but there is a certain amount of human general interest in this report, which is very satisfactory.

The next report is by Mr. Beaumont, entitled "Report from Technical Section."

Mr. Beaumont very modestly tells me that this report in his view is rather of an introductory character, leading up to the reports which are to follow, and is therefore not such a report as will require discussion. I now have great pleasure in calling on Mr. Beaumont to read his report.

MR. DAVIES:—While our President spoke of the excellent work of Mr. Vinet from more of an outside viewpoint, I want to add my words of appreciation to yours, Mr. President, Mr. Vinet has been a very excellent Secretary, and I am sure that his financial statement, by which we have something like $2,000 ahead over last year, is in every way satisfactory.

Mr. President, I have great pleasure in giving a hearty vote of thanks to Mr. Vinet for his excellent and hearty work. Seconded by Mr. Dion.

THE PRESIDENT:—Gentlemen, it is unnecessary to put the motion, because already it has been carried. I am very glad to take this opportunity to say that though I quite intentionally have refrained from much activity because I have realized that Montreal is the active centre now, it has been quite observable by me how very excellently the work has been done. It has been a great pleasure to be associated with Mr. Vinet in his work, and I have great pleasure in tendering him the thanks which have been expressed.

REPORT OF THE TECHNICAL SECTION

The Association this year changed its scheme regarding the appointment of committees so as to bring the organization and work of committees very much in line with the new plan adopted by our affiliated Association, the National Electric Light Association. This plan resulted in the appointment of a number of sections, including the Technical Section. After the appointment of the Technical Section it was decided, subject to the approval of the executive committee, to appoint the following committees: Hydraulic, Power Committee, Electrical Apparatus Committee, Meter Committee, Overhead Systems Committee.

These committees were appointed and a large amount of work done, reports upon which will be submitted during the course of this convention.

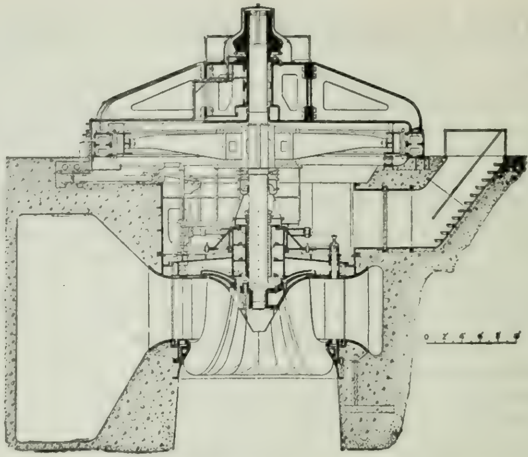
It is probably advisable to call attention to the fact that we were under certain disadvantages in that we were not very familiar with the exact details of the organization of the National Electric Light Association committees, and we also suffered from various changes in personnel of the committee owing to certain properties coming under "Government Ownership." It is here perhaps advisable to suggest for the consideration of the incoming executive committee and technical section, the advisability of drawing up a constitution along lines similar to those adopted by the National Electric Light Association. This latter would have many advantages because it would definitely decide procedure.

DEALING WITH LOCAL ASPECT.

In view of the present constitution of this association and its affiliation with the Naitonal Electric Light Association, we have to bear in mind that the work done by the National Committees is naturally much more thorough and exhaustive than can be accomplished by this Association, and the work of committees of the Canadian Association to a large extent consists of dealing with the local aspect of affairs in conjunction with reports of the National Electric Light Association.

While discussing this question of the work of the Naitonal Electric Light Association we would particularly urge our members to study the reports presented at the Chicago convention two weeks ago. These reports will be in your hands shortly, and a few words dealing with these reports may perhaps be inserted here. One is struck by obvious advantages of the new policy in allowing manufacturers to become members of the association as is evidenced by the very valuable contributions from technical experts of a number of manufacturing companies.

Reviewing the reports briefly the Electrical Apparatus Committee's report described what is probably a very important advance in switchboard designs in that absolute separation of phases is used, the idea of this being to obviate the possibility of short-circuit. This scheme is used in the new power plants being built both in New York and in Chicago. A report on a special committee dealing with the examination of equipment will also be of interest to our operating engineers.



HYDRAULIC POWER COMMITTEE.

A new committee appointed last year, the Hydraulic Power Committee, whose report is of great interest, indicates the wisdom of the appointment of a committee to specially consider this phase of the work, and I might here mention that the Canadian Hydraulic Committee have not made a report this year though the chairman, Mr. S. Svenningson, has attended several meetings and I will now read a letter from Mr. Svenningson dealing with this committee.

''I have received your letter of May 4th, and note that you are anxious to receive all technical reports on or before May 14th. In this connection I beg to state that, after due consideration the Hydraulic Power Committee has decided not to submit a report for this year due to the fact that very little of interest as regards new developments has taken place in the past year.

''Your committee feels that, due to the re-organization of the N.E.L.A., it will be desirable in the future that the Hydraulic Power Committee of the Canadian Electrical Association should work as a geographic division of the main committee. In this connection I may state that it is the intention of the present main Hydraulic Power Committee to distribute the work amongst the chairmen of the geographic divisions in such a manner that problems of particular interest to a division will be gone into in detail by this division. It is also the intention in the future to more fully go into operating features than in the past.

''The main Hydraulic Power Committee of the N.E.L.A. has during the past year made up an extensive program which it will take several years to carry out. This program, which will be fully described in the annual report of the N.E.L.A., includes design as well as operating problems which we believe will be of great interest to the members. Future reports will, of course, also include manufacturers' statements, but these statements will not play such a dominant part as in the past.

''In conclusion we wish to urge member companies to suggest any problem, which they feel should be gone into, either by the geographic division or the main committee of the N.E.L.A.

With further regard to the Chicago proceedings the Overhead Systems Committee presents a report dealing with new line constructions the use of much longer spans; the use of concrete poles and the question of pole treatment. Also, the sub-committee's report on construction materials is of great interest and suggests modifications to the present standards in the National Handbook.

There are other reports for which similar committees were not appointed by this Association. They are the Inductive Interference, Prime Movers and Underground Systems. This latter is of general interest particularly with regard to tests and figures given dealing with overheated duct runs, a problem we occasionally have with us here in the Province of Quebec.

The reports of the various committees will be given during the Convention and I hope will be found of value to all members and also that they will promote lively and wide discussion.

Respectfully submitted,

O. V. ANDERSON,

J. S. WURTELE,

E. H. HOLDER,

S. SVENNINGSON,

R. J. BEAUMONT, *Chairman.*

MR. R. J. BEAUMONT:—I move the adoption of this report. Seconded by Mr. Gilman.

THE PRESIDENT:—It has been moved and seconded that this report be adopted. Carried unanimously.

The next report of this series so interestingly introduced by Mr. Beaumont, is the report from the Meter Committee, which will be given us by Mr. Holder.

After this report, as after the others, there may be discussions. Those who take part in the discussion, no matter how well or how ill-known they may be to other members, will really confer a great kindness by each stating quite distinctly on rising his name as well as the company he represents. Obviously it is a kindness, it to no others, to the reporter of the proceedings.

We shall now have the report from Mr. Holder.

REPORT OF METER COMMITTEE, C. E. A.—1920-1921

Your Committee was organized early in the year and a preliminary meeting was held in October. It was then decided that the work of last year's Committee would be continued, so that the present report mainly follows up the resolutions passed at our last Annual Convention. The main subject was, therefore, the question of the seal period of watthour meters.

A complete report on this subject will be prepared, giving the full evidence and data collected to be placed in the hands of your main Committee with recommendations as to action to be taken on this report. The report in an amended form is as follows:—

SEAL PERIOD OF WATTHOUR METERS.

The purpose of this investigation was to collect evidence and data bearing on the seal period of watt-hour meters and their continued accuracy for a period under service conditions.

The regulations governing the testing and sealing of watthour meters are those contined in the Dominion of Canada Electricity Inspection Act. 1907.

This Act, paragraph No. 12 states:—

"The amount of electrical energy supplied by a contractor to any purchaser under the Act or the electrical quantity contained in such supply shall, if the Purchaser so desires, be ascertained by means of a suitable meter duly certified in accordanc with regulations established under authority of this Act."

A further paragraph states:—

"The suitability of the meter is to be verified and stamped before installation, and within twelve months of the expiration of five years the meter is to be recertified and restamped."

The Act, therefore, fixes very definitely the period during which a sealed meter may be left in service, and also appoints the Government Inspector as the testing authority.

Your Committee does not at present favor any fundamental change in method of sealing and certifying meters as the present method leads to accuracy of metering, the seal as a certificate of accuracy being a valuable asset, but confine themselves to a consideration of the time period between tests.

In the data submitted the house service type of A.C. Induction meter is entirely considered as representing at least 90% of the meters in use, but it is desirable that any extension of the compulsory test period apply to all types of meters. With D.C. meters it is an undisputed fact that their tendency to run slow would make a more frequent test desirable on the part of the contractor, the Act not preventing this from being done and any extension would not work an injustice upon the purchaser.

With larger power meters the desirability of greater accuracy than that called for by the regulations would similarly call for more frequent testing, which is usually a subject of arrangement between the contractor and the purchaser.

RECORD OF METERS TESTED AFTER BEING IN SERVICE FOR SEAL PERIOD OR LONGER.

Length of Service Years	Seal Year	No. Tested	Accurate 3% or –	Over 3% Slow	Over 3% Fast	Over 10% Slow	Over 10% Fast
			100% LOAD				
A. 5	1915	221	220	..	1	..	..
5	1914	77	77	..	..	..	..
5	1913	388	364	6	18	..	..
6	1912	99	92	3	1	3	..
7	1911	91	84	4	2	1	..
8	1910	46	38	5	3	..	..
			10% LOAD				
A. 5	1915	221	219	1	1	..	..
5	1914	77	77	0	0	..	..
5	1913	388	360	16	12	..	..
6	1912	99	90	5	1	3	..
7	1911	91	85	4	1	1	..
8	1910	46	39	4	3	..	..
			50% LOAD				
B. 5	1915	6077	5902	42	92	41	..
5	1914	2853	2773	28	21	31	..
5	1915	5878	5716	39	80	43	..
5	1912	6335	6020	42	218	55	..
5	1911	7809	7377	47	356	29	..
5	1910	8669	8414	163	46	46	..
			4% LOAD				
B. 5	1915	6077	5901	131	1	44	..
5	1914	2853	2691	106	0	56	..
5	1915	5878	5660	155	5	78	..
5	1912	6335	6083	166	6	80	..
5	1911	7809	7486	269	5	49	..
5	1910	8669	7599	990	3	77	..
			100% LOAD				
C. 0	1920	580	531	47	0	48	0
1	1919	480	457	21	1	20	0
2	1918	273	255	16	1	14	1
3	1917	204	193	10	1	8	0
4	1916	155	137	18	0	11	0
5	1915	135	122	10	2	6	0
6	1914	195	183	11	1	8	0
7	1913	3818	3778	36	3	34	0
	and others	178	172	5	1	4	0
			10 %				
C. 0	1920	580	529	49	0	47	2
1	1919	480	453	23	1	22	0
2	1918	273	250	18	2	15	2
3	1917	204	190	13	1	8	0
4	1916	155	157	16	0	13	0
5	1915	35	119	14	1	5	1
6	1914	195	180	13	2	8	0
7	1913	3818	3765	45	9	34	0
	and others	178	165	9	4	4	0

The A.C. house service type of meter is, therefore, the only type which will fall within the Act as regards the reseal period.

In the interpretation of the regulations where the contractor operates a Meter Department, the following system is followed:—

The new meter of an approved type is checked over at such points as experience finds desirable, and it is then passed over to the Government Inspector for testing and test is made at 100% and 10% load and creeping, and if the meter falls within the limit of 3% + or — it is certified correct, sealed and certificate issued. The meter is then ready for installation, and if its accuracy is not in the meantime disputed, remains in service for five years.

After five years the Contractor is notified that the period has expired and within the sixth year the meter is brought into the shop for retesting. It is tested at the decided upon points, and the test recorded. The seal is broken, the meter is cleaned, oiled, repaird, and adjusted correct. It is then handed over to the Government Inspectors, who test at 100% and 10% load, reseal and certify.

The meter is then again ready for a further five years' service. This system, if carefully followed, makes sure that all meters leave the shop in first-class condition and that a high degree of accuracy is maintained.

With smaller concerns that do not maintain a meter department a different system is adopted. They are visited at intervals by a Government Inspector, who asks that all the time expired meters be produced for reverification. The meters are brought in, tested, and if found within the limits are resealed for a further period. It then happens that the majority of the meters are put out into service for a further five-year period without receiving any further attention and it may well happen that meters so tested have been in service for two or three test periods without inaccuracy showing up. With an extension of the initial test period it is possible that a larger proportion of the meters would be overhauled at the end of the period, and the result would be a reduction of the period during which the majority of the meters are in service without overhauling and a greater degree of accuracy maintained.

It has for some time been apparent to those handling the testing and resealing of large quantities of watthour meters, that the modern A.C. house service type of meter is a very accurate and reliable instrument, and at the end of the seal period but a very small proportion were inaccurate. During the latter part of the war period it was found, owing to the great scarcity of man power, that the Companies were not in a position to adhere strictly to the rules of the Government Inspection Department, and it was found that even with an increase of one, two or three years but a very small proportion of this type of meter was inaccurate and the conclusion arrived at was that the extension of the period was not imparing the accuracy of metering.

RECORD OF METERS TESTED AFTER BEING IN SERVICE FOR SEAL PERIOD OR LONGER.

Length of Service Years		Seal Year	No. Tested	Accerate 3% or –	Over 3% Slow	Over 3% Fast	Over 10% Slow	Over 10% Fast
				100% LOAD				
D.	1	..	460	436	18	6	..	..
	2	..	210	188	20	2	..	..
	3	..	245	228	116	1	..	..
	4	..	229	215	10	4	..	..
	6	..	182	9	7	..	..	..
	5	..	3182	2970	175	37	..	..
				10% LOAD				
D.	1	..	460	..	..	..	..	..
	2	..	210	..	..	..	..	..
	3	..	245	..	..	..	..	.
	4		229	..	..	..	..	..
	5	..	182	..	..	..	..	..
	6	..	3182	..	..	..	..	..
				100% LOAD				
E.	10	1910	16	15	1	0	0	0
	9	1911	39	37	2	0	0	0
	8	1912	172	152	10	6	4	0
	7	1913	222	189	23	2	8	0
	6	1914	556	514	11	19	12	0
	5	1915	584	562	8	7	7	0
				10% LOAD				
E.	10	1910	16	13	2	0	1	0
	9	1911	39	34	5	0	0	0
	8	1912	172	112	46	4	10	0
	7	1913	222	155	59	1	7	0
	6	1914	556	445	77	19	14	1
	5	1915	584	496	70	9	9	0
				100% LOAD				
F.	10	1910	1	1	0	0	0	..
	9	1911	4	2	0	0	2	..
	8	1912	5	4	0	0	1	..
	7	1913	7	7	0	0	0	..
	6	1914	471	470	0	0	1	..
	5	1915	256	255	0	0	5	..
				10% LOAD				
F.	10	1910	1	..	..	..	..	..
	9	1911	4	..	..	..	..	..
	8	1912	5	..	..	..	..	..
	7	1913	7	..	..	..	..	..
	6	1914	471	..	..	..	..	..
	5	1915	256	..	..	..	..	..

In the collection of evidence and data your Committee asked member companies to submit test results according to the following form, and a large amount of valuable information was received. This not only indicated test results after the five-year period but in many cases up to a period of eight years.

The information asked for with regard to meters found inaccurate in service was not generally supplied, no separate data being apparently kept of this.

METERS TESTED AFTER BEING IN SERVICE FOR SEAL PERIOD OR LONGER. TEST AT FULL LOAD 100%.

Seal Year	No. Tested	Accurate 3% + or —	Over 3% Slow	Over 3% Fast	Over 10% Slow	Over 10% Fast

TEST AT LOW LOAD 10%

Seal Year	No. Tested	Accurate 3% + or —	Over 3% Slow	Over 3% Fast	Over 10% Slow	Over 10% Fast

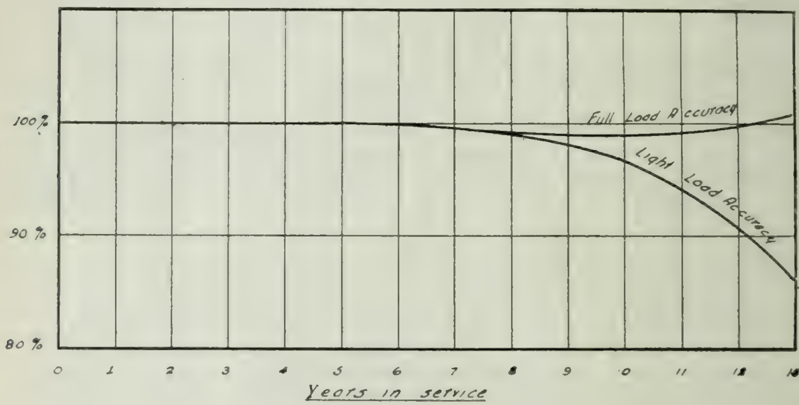
RECORD OF METERS FOUND INACCURATE IN SERVICE

Seal Date	1920	1919	1918	1917	1916	1915	1914 and Earlier

A summary of the tabulated data received shows that for over 30,000 time-expired meters tested, 96 per cent were accurate within the 3 per cent limit.

It will be noted in studying list C, that the proportion of inaccurate meters does not depend on the period during which the meters have been in service, and that the largest number of stopped meters were amongst those which had been in service for a short period. The Member Company supplying this list also states that the majority of the stopped meters were registering before removal from the customers' premises, which would indicate that they had been injured whilst handling.

A number of a similar type were tested, which had been in normal service for periods ranging up to 13 years, and the attached curve shows the average full and light load accuracies of these meters plotted against the length of time for which they have been in service. It is seen that the full load accuracy changes very little, bending upwards slightly, apparently due to magnet ageing. The light load curve drops after eight years' service, due to dust and friction.



Accuracy of Watthourmeters in service

The two main points affecting maintained accuracy of watthour meters are:—

(1) Friction caused by wear and dirt makes meter register slow. Chiefly on light loads.

(2) Change in braking effect of drag magnets.

Shortage of the right quality of steel during the war period was looked upon as a possible source of magnet trouble, but the errors which should show up during the first period of the life of the meter, are not guarded against by our present five-year period tests.

That the manufacturers of meters have the improvements of the designs along the lines of maintained accuracy at heart is shown by the following replies to questions upon this point:—

A. REPORTS.

"Assuming anything approaching normal conditions of service, maintained accuracy is generally considered as depending upon performance of the meter bearings and of the permanent magnets. In regard to magnets, knowledge of the proper method of manufacture and testing of permanent magnets has advanced tremendously in the last few years, and it is fairly safe assumption that the magnets of any well established Meter Manufacturer have a factor of safety which will assure absolute permanence under

anything approaching normal conditions of service for periods of time much in excess of the period suggested for Government sealing.

"The question of bearings and jewels is, of necessity, a little more uncertain. Methods of cutting and polishing jewels, hardening and finishing of pivots have greatly improved in recent years, however, and as far back as seven years ago when these methods were considerably less refined, we have a knowledge of laboratory tests under forced service conditions approximating 20 years' continuous service on two of the well-known types of meters with their own bearings, and with interchanged bearings, without any appreciable change in accuracy.

B. REPORTS.

"With regard to the seal period, we see no reason why this could not be extended as far as our meters are concerned.

"The permanency of the magnets depends mostly on the heat treatment before magnetization and the artificial ageing after magnetization. The magnets used by reliable meter manufacturers can be considered practically permanent. The writer does not remember of one case in which the magnets weakened so that they had to be replaced."

C. REPORTS.

"We give it as our opinion that the period for the re-examination could well be extended on house service type meters."

In drawing a conclusion from the data submitted, your Committee kept in mind the following points:—

(1) Maintained accuracy of metering equipment.

(2) Maintenance of public confidence in metering equipment.

(3) Modification of cost of present test period system.

(1) Maintained accuracy would be benefitted generally by an extension of the seal period by three years, eliminating part of the handling and increasing chances of each meter receiving periodically a thorough examination.

(2) The data submitted shows extreme accuracy of house service type meters under extended service conditions, and that the seal affixed is a guarantee of this accuracy.

(3) There were 182,000 meters sealed during 1920 which if due to be sealed after five years would cost an average of $56,440 per year, but if extended by three years, this cost would be reduced to $35,275 per year, a saving of $21,165 per year upon the 1920 date meters.

Your Committee is, therefore, in favor of an extension of the present five-year seal period by three years.

PROVISION OF SEALED ENTRANCE BOXES.

The Canadian Underwriters' Electrical Inspection Bureau in an amendment of the 1920 edition of the National Electrical Code to be enforced after March 1st, 1921, have inserted the following rule:—

"The inner end of the service conduit must extend into a metal service box containing the service cutout and main disconnecting switch, located inside the building at the nearest accessible point to the place where the service wires enter the building.

"The service box must be of approved design, arranged to be operated from the outside of the enclosure equipped with a locking or sealing device, and shall be so marked as to indicate without opening the enclosure, whether the switch is in the 'on' or 'off' position."

From the point of view of the Quebec Member Companies such a rule is a step in the right direction, as new services will be provided with such a box as part of the wiring installation and arrangements may be made by the supply authority for sealing the same.

METER STANDARDIZATION.

A watthour meter section of the Canadian Engineering Standards Association has now been formed under the Chairmanship of Prof. L. W. Gill, Director of Technical Education, Ottawa, upon which Committee the Association is represented. It is intended to prepare specifications for watthour meters together with the necessary transformers which will have as general acceptance as possible, and will cover such points as standard method of testing, degree of accuracy to be called for, standard arrangements of dials and the like. Preliminary information is being collected.

HANDLING AND STORING OF METERS.

The collection of data concerning the maintenance of watthour meter accuracy brought out the fact that more inaccuracies could be caused by rough handling between test room and customer than by continued normal service. Your Committee consider it very important that attention should be given to this part of meter work, bearing in mind that meters are precision instruments. The type of storage rack adopted by one of our member companies and a later improvement of this rack are shown in the illustration.

EDUCATION OF METERMEN.

It has been suggested that some attention might be given to the proper training of our metermen along the lines suggested by the Meter Committee of the N.E.L.A. It is also suggested that this subject might be advantageously taken up by some of our Technical Schools with a view to having them adopt some such course.

MEASUREMENT OF MAXIMUM DEMAND.

With the increase in operating costs more attention has been given during the past year to the accurate measurement of Maximum Demand, and the Maximum Demand Meter has come into more general use. There is at present a necessity that a definite method be devised for the checking of these demand meters. The standardization of the time period might also well be considered at this time. The various time periods used cover a wide range, and some call for a sustained peak and others for an average over the period. This state of indefiniteness and variation creates a bad impression in the minds of the customers, and is one which some effort should be made to remove. It would seem that a standard of 10 or 15 minutes peak would be desirable.

There is now on the market an attachment which can be applied to certain forms of demand meters, which will permit the demand being measured in K.V.A. This device is sufficiently reasonable in cost and commercially accurate over wide ranges of power factor to justify the question being raised as to whether demand should not be based on K.V.A. in place of present somewhat cumbersome system of K.W. demand plus a penalty clause for bad power factor.

NEW DEVELOPMENTS.

The various Meter manufacturers are now producing a high class type of meter, the A.C. induction type being specially designed for long maintained accuracy under service conditions and ease of testing and calibrating. The type R. watthour meter of The Packard Electric Co. and the type F.D. of the Ferranti Meter & Transformer Co. are late productions of this type, the latter introducing many new features of design. The Sangamo Co. type H. meter has now a special clip on dial and gear train and improved type of case and terminal cover.

The Canadian General Electric Co. are producing for sale in Canada their new type M. 7 register for converting type I. 14 meters into a definite time interval maximum demand meter which register makes use of a Warren motor combined in the register for the time resetting portion.

The Lincoln Meter Company have produced a new type of Graphic meter driven by synchronous motor in place of the usual clock. The measuring element is the same as their standard indicating type. This combination gives an integration of the load over the time period before the pen records the same. This results in the maximum demand being the highest point the pen reaches on the chart, on variable loads this is a distinctively valuable feature.

The same Company have also produced a small auto transformer which, attached to their demand meter, causes same to read in K.V.A. between certain limits of power factor. Two sets of taps are provided on this transformer, one covering power factors from 99 to 65%, and the other power factors from 75 to 43%. If the power factor at the time of demand is outside the connected range, any errors occurring will be in favor of the customer, which is the safe direction for an error if any is to be made, as the user cannot attack the method on the grounds of an over registration of his demands.

Your Committee was also represented by four members upon the Meter Committee of the National Electric Light Association, and meetings were attended by these members and an active part taken in the work of this Committee. It is to be noted that this Committee is entirely formed from amongst Central Station metermen, and that their standing is such that new designs and methods are submitted to them by manufacturers for criticism.

A resume of the work of the N. E. L. A. Committee follows:—

RESUME OF 1921 REPORT OF N. E. L. A. METER COMMITTEE EDUCATIONAL WORK.

An outline of various short courses for metermen arranged by various Engineering Colleges and Universities are given, and also of complete courses being adopted by the Westinghouse & General Electric Co. These courses were favourably reported upon by members of the Committee.

EXTENSION OF TEST PERIOD.

Data were collected from member companies bearing on this subject. These data reported favorably upon the continued accuracy of small A. C. Induction meters. An outline of a standard form for collecting these data was made. It was decided to continue the collecting of all possible test results.

The adoption of short cut methods for speeding up tests was not favored.

STANDARDIZATION OF METER DESIGN.

Desirable changes in construction of meters and instruments now being manufactured were recommended and any new apparatus or changes in present apparatus were inspected and criticised, suggestions for improvements being made.

The following are the special items taken up during the past year:—

(1) BOTTOM CONNECTED DIRECT CURRENT METERS:—The demand for such a meter ranging up to 75 amps. was brought to the attention of different manufacturers, some of whom are now working upon its design.

(2) WATTHOUR DEMAND METERS: — The size and overload capactiy of the scale marking received attention. It was decided to ask manufacturers to adopt the following full scale marking:—

For single phase metesr, 150% of full load capacity of watthour meter. Full load being amps. × volts.

For polyphase meters, 125 to 150% full load capacity with a tolerance of plus 5%. Full load for the two phase meters being amps. × volts × two.

For three phase meters (3 and 4 wire) to be volts × amps. × square root of three. Delta voltage being used, one hundred and fifteen (115) volts or multiples thereof to be used when arriving at full load capacity of watthour meters.

Larger demand scales were also asked for.

(3) DISC CONSTANTS. To ask for standard disc constants was felt to be putting a possible restraint on new development, which is not the desire of the Committee. It was appreciated that benefits would be conferred by a uniform disc constant, and a recommendation was made that should conditions ever permit, meters of same rating but of different makes should have the same constant, and the constant should be in direct proportion to meter capacities.

(4) DIRECTION OF ROTATION: — A counter clockwise rotation of moving element is favored. That is, a left to right movement when looking at the front of the meter.

(5) CLEAR SPACE ON METAL COVER FOR COMPANIES' NUMBERS — Sufficient space on front of cover for Companies' number was desired.

(6) REPEATING OF METER DIAL:—Section of code which states that no meter should repeat when operated on full load, 24 hours per day, for 25 days, was emphasized.

(7) DIGEST FOR RECOMMENDATIONS for years 1913-1920 was prepared from Committee reports and minutes.

METER LECTURE.

This is being prepared for publication in this year's report and separate publication. The lecture will be complete with illustrations and diagrams and will make a complete lecture on metering, available for general use and instructional purposes.

REVISION OF ELECTRIC METERMAN'S HANDBOOK.

It is proposed to start this work during the coming year, as the present edition is liable to become out of print and not to contain the latest developments.

METHODS OF MEASURING POWER FACTORS AND K.V.A.

A complete report was prepared on this subject in which the different methods in present use are described.

The methods of obtaining power factor from readings of reactive component meters is entered into in full detail.

Connections for obtaining approximate K.V.A. hours under certain conditions are given.

OUTDOOR METERING EQUIPMENT.

The necessity of placing instrument transformers out-doors under certain conditions was recognized, but it was considered that the actual meters should, wherever possible, be placed indoors, and in every case should be provided with a proper housing.

MAINTENANCE OF SWITCHBOARD METERS AND INSTRUMENTS.

Data were collected bearing upon practice with regard to the above. These data were not very complete but showed as a general rule that the Meter Departments were responsible for the maintenance of switchboard meters and instruments. The installation of watthour meter on separate panels from the control and other instruments was favoured. There was a diversity of opinion with regard to testing schedule and methods.

RELAY MAINTENANCE.

The majority of members of the Committee reported that their Meter Departments were responsible for relay maintenance. It was decided to co-operate with the Apparatus Committee in preparing future reports on this matter, as relays are primarily protective devices.

Respecfully submitted this 15th day of June, 1921.

E. HOLDER, *Chairman.*

E. J. TURLEY.	S. L. B. LINES.
WM. VOLKMAN.	E. R. SPENCE.
P. S. GREGORY.	E. G. RATZ.
L. W. PRATT.	G. A. WENDT.

MR. E. HOLDER:—I move the adoption of this report.

Seconded by Mr. Davies.

THE PRESIDENT:—It has been moved and seconded that this report be adopted, and it is open for discussion now. You have probably all read the report besides listening to it, so that you are aware if there is anything you wish to discuss. It is a pity, if anybody wishes to have a point cleared up, not to mention it.

MR. O. HIGMAN:—Mr. President, the impression conveyed by the gentleman who has read the paper is that the test period is five years. Now clearly the act states it to be six years, — that is reverification within one year after five years, and I know the companies avail themselves to the full of the six year limit, so that it is a six year period and not a five year period. With regard to the statement that 90% of the meters brought in after six years' use are accurate, I wish to say that I cannot agree with that statement. Insofar as the larger companies are concerned, we have no means of checking their accuracy of that statement. The meters are brought in, opened up and cleaned and adjusted ready for our Inspector, and they are so adjusted as to be invariably correct when our Inspector tests them. But with regard to the small companies I may say that quite a large proportion of the meters are outside of the 3% limit—either slow or fast. The small companies, as you know very well, have no outfit for repairing and testing meters, and they are brought right to the test board, where we are able to ascertain the conditions they are in. One of the towns in Western Ontario recently, which had been in default with regard to their meter inspection, was told that unless they complied with the law, we should have to put them into court. The meters had gone seven or eight years without testing and so they were brought in. A large number of them were found to be quite slow, certainly below the limit allowed in the act, and some months after the test had taken place, we received a very complimentary letter from the Company, thanking us for insisting on their bringing in the meters, as their revenue had increased considerably since that time (laughter).

It has been suggested that we make the test period one of ten years. Now in my humble judgment to do that would make a farce of the whole proceeding. Six years is a long period for a meter to be in use without readjustment and testing. The tariff, supposing that a meter runs for six years, is 10 cts. per annum, not a very extravagant charge. I may tell the Association that only last Fall when the Acting Minister of our Department was reviewing the revenues of different branches of the Department, I was asked whether we could not reduce the period of test to three years instead of six, and at the same time increase the inspection charges. I objected, of course, and fought that suggestion, and will continue to do so if it ever comes up again, because I think our present arrangement is a very good one, and the inspection fee fairly reasonable. I do not think, in the interests of the companies, that you can afford to keep a meter out for nine or ten years without overhauling. I have been quite a little time at the business and that is my impression.

It was stated in the report that there is never any trouble now with regard to the permanent magnets. It was only two weeks ago that we sent a meter to one of the manufacturers in order to have some repairs made. We do not undertake structural repairs but we make readjustments. The part that was damaged was repaired, but the instrument was sent back unadjusted and untested, and in going over it we found it was 40% fast—in

fact, that the magnet was inoperative. So we sent it back again and we got a letter of apology, stating that they had not tested the meter at first. A new brake magnet was put in. Now this shows to me clearly that you cannot depend on the magnet. I admit that the conditions are very much better now than they were 25 or 30 years ago. When we first introduced the work probably 50% of the meters were going fast. The first year that we made tests at least 50% of the meters were racing, and that was due almost entirely to the magnet having lost its power. So this trouble, while it has been largely eliminated, has not entirely disappeared, and for that and other reasons I would say that we should maintain the six year period of test. (Applause.)

MR. DION:—The members of the Meter Committee who desire longer test periods for meters no doubt will feel somewhat disappointed at the remarks which have just been made by Mr. Higman. He leaves little hope for any change in that direction. Personnally, I do not think I care very much whether the test period is changed or not at this time, but I wish to say that when Mr. Higman speaks as he does, he speaks with entire sympathy with the industry. Living in Ottawa, I have had frequent interviews with Mr. Higman, and I want to assure this Association, that whatever views Mr. Higman may hold on this point, he is perfectly sincere. He has always shown sympathy, and it has been an unfailing pleasure to interview him. because we have always felt that insofar as was in his power we were treated with justice.

I would like to add this, as there are representatives of the press here, and these matters will become public, I would like to call their attention to the tables in this report. They might draw the impression from what Mr. Higman has said that the meters are on the whole inaccurate. That would be a wrong impression to take, because in consulting the tables which are published in the report, it will be seen that a very small proportion of meters are inaccurate, and fast. The majority of those of the small number that are inaccurate are slow rather than fast.

MR. HIGMAN:—I might correct the impression with reference to the fast conditions. It was in the early testing that the magnetic conditions were not as they are today. It is well know that every piece of mechanism tends to go slow under protracted use.

MR. DAVIES:—I think the member companies generally are indebted to the Committee for this excellent report. A tremendous amount of work must have been needed to get out these tables, and the results are complete. The figure of 96% out of 30,000 meters within the 3% limit is a wonderful result. I did some of this work at an earlier date at the time when some of the meters were of the type Mr. Higman finds inaccurate, and I must say our results on the old time meters were not as good. Our results on the modern meters check up very well with the results of this paper. The number of meters that are fast are less than insignificant — the total, I think, is 10 fast out of 30,000 meters.

There are one or two questions I would like to ask Mr. Holder. There is reference in this paper to various letters, A B C D E and F. Does that refer to the makes of the meters or the companies supplying them?

MR. E. HOLDER:—They refer to the member Companies supplying the data and are taken as being representative of the larger supplying Companies who are in a position to give us accurate test results of meters when they are brought in from service.

MR. DAVIES:—I would back the Meter Committee up in connection with a longer seal period. From the evidence presented here, especially that on page 24 there is every reason for the seal period to be longer. In connection with the cost, it is not the 10 cts. per annum for sealing that affects the companies at all. This is the smallest item. The main expense is the cost of taking down the meter, bringing it in, checking it and putting it back again. In large cities, such as Montreal and Toronto, this cost can be kept down, as the meters can be handled in bulk. In some of the scattered districts, instead of costing $1.50, it runs to $3 or $4. Divided by 5 or 6 years means 80 cts. per annum as against 10 cts. for cost of sealing. So the extension of two years means $1.50 saved. It would pay the Companies to pay an additional amount for sealing purposes if the Department wants revenue, rather than have it cut down the 6 year period.

Regarding suggested standardization of demand interval it would be a fine thing to standardize length of time periods, also a method of determining the demand. But I am rather doubtful as to whether any committee should make definite recommendations at the present time. The recommendation of a 10 or 15 minute peak is not in my opinion wise. There are loads which run only 3 or 4 minutes, and a 10 minute peak would not be fair to the power company. The peak, which represents the amount of capacity that the Company has to keep available to supply the demand, varies very much in the type of operation carried on. It is very difficult indeed to establish a peak interval at any one duration, and I would like to make an exception to any standard of 10 or 15 minutes suggested in the report.

As I said before, Mr. Chairman, it is a very great pleasure indeed to compliment the Meter Committee. It is the best meter report which has been presented to the Canadian Electrical Association.

MR. RUFFS:—I would like to suggest the 10 years instead of 5 or 6.

MR. E. J. TURLEY:—In connection with the extension of seal period, and particularly with reference to Mr. Higman's statement that the revenue should not be interfered with, I think that the Companies are quite in accord with what Mr. Davies suggested. As a matter of fact, there is no reason why we should not pay a little more than 10 cts. a year if the sealed period was extended. It would be saving us trouble and would be accommodating Mr. Higman's Department.

MR. HIGMAN:—It was not a case of revenue at all. It was a case of not lenghtening the test period. That is the only question.

MR. TURLEY:—I understand that the Minister of the Department thinks that the Revenue should be increased. I think that this will probably be an opportunity to have it increased, if necessary, and also save money to the companies by extending this seal period. In regard to the question of accuracy of meters after an extended period, the tables prepared here are the results of thousands of tests. As a matter of fact, the tables which our Company supplied were on tests of about a month and a half. Last year we tested something like 40,000 meters in our Meter Department. This year our quota is something like 50,000. That is practically one-fourth of

the total number of meters that were sealed in the Dominion of Canada last year, and our experience shows that the Public does not suffer any from inaccurate meters—that the Companies are the ones who suffer the most, and if they are desirous of having the period extended, I do not see why the public should object, and that is the interest which I understand is protected by the Government, although Mr. Higman mentioned one company who profited by his advice. I can mention another company which quite substantially profited by the advice of the Government, and that is our own company. We have frequently had meters sent back by the Government Meter Department which have passed through our test.

Another advantage we have over American companies is the seal which is mentioned in the report. American companies have not the advantage of a Government seal, and when it comes to a discussion with customers they have not the advantage of the government test which we have.

MR. L. W. PRATT:—I listened with a great deal of interest and respect to the remarks of Mr. Higman, who I have had the privilege of knowing for a great many years, and am rather disappointed at the stand he takes, although I fully appreciate the situation with regard to the smaller companies. We, however, usually look at these things from our own standpoint, and I agree fully with Mr. Turley in his remarks in regard to the sustained accuracy of the modern watthour meter. We sent in a report to the committee, which will be found in their bulletin, showing that not one of our meters in Hamilton that had been out for over five years and tested during the year 1920, exceeded the Government limit, either fast or slow. The larger companies use every precaution to insure the meters lasting to the end of the seal period. We use the finest grade of watch oil, and adjustments are made so that they will not loosen up in course of time. The work is done by experts who are doing nothing else, so that our problem is quite different to that obtaining in the small companies. The majority of meters which are presented for sealing and resealing are owned by the larger companies, and that is one reason why we feel that an extension is desirable. I cannot recall in the last ten years where we have made a rebate for a meter over-registering. The Government Inspector of the Hamilton District was at one time in our Meter Testing Department, and he knows what can be done with meters. He does not insist upon meters being within 3% fast or slow. He insists that we make them 1%, and we do it without any trouble. It is not a question of saving money on sealing, as I see it. It is rather on the labour involved in bringing the meters in more frequently than necessary, and I hope that the Department will consider the problems of the larger companies as well as those of the smaller ones.

THE PRESIDENT:—I should like to say a word or two. I should judge that the view of this Association is distinctly in favour of an enlargement of the period. On the other hand, it has been in a quite friendly way intimated to us by Mr. Higman that in his judgment the period should not be extended. In doing so, he has pointed out to us that there has been, the feeling in certain quarters, that the period, far from being extended, should be shortened. I do not think, of course, that that will ever obtain, but the fact that any such view exists is significant. Mr. Higman has intimated to us his view at the present time. I should like, quite delicately, to point out that obviously any period of necessity, is arbitrary. As Mr.

Higman at the present is in favour of a period longer than that held by some far less well informed than himself so I am hoping, as all of us doubtless hope, that his view may change in the direction we desire.

In the case of large companies there is a most satisfactory result already obtained, and the idea which has been running through my own mind is this, that it is perhaps not quite the reasonable thing when you find that situation, that they should be hurt by reason of the circumstances that others do not live up to so high a standard. I have wondered if there may not be some method adopted whereby there may be a greater assurance with regard to the small companies whose instruments have offended. In respect to the larger companies, the situation is obviously of the best, and as there is no law of the Medes and Persians, saying that 5 or 6 years is absolutely the right thing, it is quite conceivable that later on Mr. Higman himself may find that as he now feels (in opposition to the judgment of those less well informed) that 5 is a reasonable period may later on feel that 8 or even 10 is reasonable. If I am invited to give my own opinion, it is 10 years until a longer period is advisable. But because I hold that view I would not insist that it be adopted. I am quite convinced of this, that the mind of any reasonable man, and Mr. Higman is of that class as all of you know, is tremendously affected by actual figures and facts. Obviously, the matter, within limits, has to be arbitrary, but I feel, that the larger companies have demonstrated that it might well be considered whether the time should be extended from 6 to 10 years.

Now, as we have other matters to attend to, I shall submit it to the Meeting whether the Committee's report shall be adopted. All in favour? (Adopted unanimously).

I declare the motion carried unanimously.

We now pass to the next item, which is report on the "Electrical Standards and Their Application to Trade and Commerce". That paper is to be read by Mr. O. Higman, who is Director of the Electrical Standards Laboratory, Ottawa. I assure you that it is only those who have been circumstanced, as several in the room, like myself, have been during the history of electrical matters, who really know this official who is now going to read this paper to us. I do not like paying extreme compliments in the presence of the man of whom I am making the remarks, but I do wish to say this, that in my judgment any Province in Canada would have been very well off if it had had, with reference to its electrical matters, such an arbitrator of affairs as the Federal Government has had at Ottawa. In him we have found an official who has determined, so far as my view has been concerned, to see that the interests of the public shall be conserved, and who also has been careful to see that private interests should have justice. Nothing more and nothing less has ever been asked for, so far as I am aware, and nothing more and nothing less has been meted out to us by Mr. Higman, who is about to read this paper.

MR. HIGMAN:—I reserve for another occasion my thanks to you for your all too flattering remarks. It is true I have been conscious of the fact that I have had the consumer to protect primarily, but nevertheless, I have always been conscious of the fact that the company is entitled to justice and proper treatment at my hands.

ELECTRICAL STANDARDS AND THIER APPLICATION TO TRADE AND COMMERCE

(By Ormond Higman, Director, Electricity & Gas Inspection Services and Laboratories, Ottawa.)

In 1892, the Minister of Inland Revenue invited the writer to draft the necessary legislation for the introduction of an electricity inspection service under the general system of Weights and Measures. For some years previous to this the Canadian Gas Companies had been making complaints to the Department because of the fact that while gas and gas meters were inspected electricity meters remained uninspected. In taking up the question of the introduction of a system of electricity inspection, obviously the first consideration was that of establishing, at headquarters, the fundamental units or standards of electrical measure on which the work of testing electric meters and other appliances could alone be based. For how could the Government undertake to question the accuracy of a meter used in the sale of electricity without first being assured that its own testing appliances were accurate?

The solution of the problem of establishing a system of fundamental standards was greatly facilitated at this time by the meeting of an International Electrical Congress at the Worlds Fair, Chicago. The writer was appointed by the Government to represent British North America at the Congress and as a result of the deliberations of the Congress a system of electrical units was adopted and a recommendation made that the Governments represented should establish the units in their respective countries by legislative action. Accordingly during the parliamentary session of 1893-4 the Electrical Units Act together with the Electricity Inspection Act were passed. In order that we may have a comprehensive and progressive record of what has taken place in regard to electrical units, the Act embodying the Chicago resolutions follow:—

An Act respecting the Units of Electrical Measure.

1. This Act may be cited as the Electrical Units Act.
2. The units of electrical measure for Canada shall be the following:—

OHM.—(a) As a unit of resistance, the ohm, which is based upon the ohm equal to 109 units of resistance of the centimetre-gramme-second system of electro-magnetic units, and is represented by the resistanc offered to an unvarying electric current by a column of mercury, at the temperature of melting ice 14.4521 grammes in mass, of a constant cross-sectional area and of the length of 106.3 centimetres;

AMPERE.—(b) As a unit of current, the ampere, which is one-tenth of the unit of current of the centimetre-gramme-second system of electro-magnetic units, and is represented sufficiently well for practical use by the unvarying current which, when passed through a solution of nitrate of silver in water, and in accordance with the specification contained in schedule one to this Act, deposits silver at the rate of 0.001118 of a gramme per second;

VOLT.— (c) As a unit of electro-motive force, the volt, which is the electro-motive force that, steadily applied to a conductor whose resistance is one ohm, will produce a current of one ampere, and which is represented sufficiently well for practical use by 1000/1434 of the electro-motive force between the poles or electrodes of the voltaic cell known as Clark's cell, at a temperature of 15° Centigrade and prepared in accordance with the specification contained in schedule two of this Act:

COULOMB.(d) As a unit of quantity, the coulomb, which is the quantity of electricity transferred by a current of one ampere in one second;

FARAD.— (e) As a unit of capacity, the farad, which is the capacity of a condenser charged to a potential of one volt by one coulomb;

JOULE.— (f) As a unit of work, the joule, which is equal to 10 units of work in the centimetre-gramme-second system, and is represented sufficiently well for practical use by the energy expended in one second by one ampere in one ohm;

WATT.— (g) As a unit of power, the watt, which is equal to 10^7 units of power in the centimetre-gramme-second system, and is represented sufficiently well for practical use by the work done at the rate of one joule per second;

HENRY.— ((h) As the unit of induction, the henry, which is the induction in a circuit when the electro-motive force induced in that circuit is one volt, while the inducing current varies at the rate of one ampere per second.

3. The units of electrical measure described in this Act, or such standard apparatus as is necessary to produce them, shall be deposited in the Department of Inland Revenue and shall form part of the system of standards of measure and weight established by the Weights and Measures Act.

Fifteen years after the action taken at Chicago, the British Government (in October 1908) called a conference in London to further consider the Units of electrical measure adopted at Chicago and to revise these units should it be deemed necessary to do so. Representatives from most of the Governments of Europe and America attended the conference and as a result of the deliberations of the conference all but the three primary units the Ohm, Ampere and Volt, were deleted from the list and today the international units of electrical measure stand as follows:—

His Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:

1. This Act may be cited as The Electrical Units Act.

2. The units of electrical measure for Canada shall be the following:

OHM.— (a) As a unit of resistance, the international ohm, which is based upon the ohm equal to 10^9 units of resistance of the centimetre-gramme-second system of electro-magnetic units, and is represented by the resistance offered to an unvarying electric current by a column of mercury, at the temperature of melting ice 14.4521 grammes in mass, of a constant cross-sectional area and of the length of 106.300 centimetres arranged in accordance with the specification contained in schedule A to this Act;

AMPERE.—(b) As a unit of current, the international ampere, which is one-tenth of the unit of current of the centimetre-gramme-second system of electro-magnetic units, and is represented by the unvarying current which, when passed through a solution of nitrate of silver in water, and in accordance with the specification contained in Schedule B to this Act, deposits silver at the rate of 0.00111800 of a gramme per second;

VOLT.— (c) As a unit of electro-motive-force, the international volt which is the electro-motive-force that steadily applied to a conductor whose resistance is one international ohm, will produce a current of one international ampere. The Western Normal Cell may be used as a standard of electric pressure, and when set up in accordance with the specification contained in schedule C to this Act, may be taken as having, at a temperature of 20° C., an electro-motive-force of 1.0183 volts.

3. Such standard apparatus as is necessary to produce the units of electrical measure described in this Act, shall be deposited in the Department of Trade and Commerce and shall form part of the system of standards of measure and weight established by the Weights and Measures Act.

4. The Electrical Units Act, chapter fifty-three of the Revised Statutes of Canada, 1906, is hereby repealed.

A comparison of the two Acts will show that apart from the deletions already alluded to, very few changes were made in the three primary units. Two zeros were added to the length of the mercury column of the Ohm, two zeros to the rate of deposition of silver in the determination of the ampere. These zeros are, of course, of no value in respect of the determination of the units, but were added simply to prevent experimenters from adding to or taking from the values arrived at by the Conference. It will also be noticed that the Western Normal Cell has been substituted for the Clark Cell as a practical standard of electric pressure. The word "international" has also been added to each primary unit.

An effort was made at the Conference to have the volt placed as the second primary unit. One may pick up a piece of wire and find therein an expression of resistance, or a primary cell that will give you an expression of voltage, but no one ever came across anything possessing a residual manifestation of an ampere. A motion was made to give the volt the second place and this was supported by the representatives of the United States, Canada, France, Italy and Japan, but without avail, the motion being defeated by a considerable majority. There can be no doubt, however, that the ampere should be the derived unit and not the volt.

EQUIPMENT OF STANDARDIZING LABORATORIES.

We will now revert back to 1894 when the equipment of the standardizing laboratories had to be undertaken. The problem of procuring the necessary apparatus for producing the standards of electrical measure was not so easy at that time as it is today. The only standard instruments then available were the electro-static voltmeters and balances invented and manufactured by Lord Kelvin. A number of these instruments, made

especially for the department, were procured, covering ranges from 0 to 3000 volts; 0 to 3000 amperes and 0 to 30,000 Kilowatts. To these we were able to add the Clark cell and the Crompton potentiometer with copies of the Ohm, shunts and other auxiliary testing appliances.

Continuous current was furnished, of course, by means of accumulators but the production of alternating currents suitable for standardizing purposes was a matter of some concern. An a.c. generator belted to a d.c. motor operated from storage batteries was tried but was not of sufficient flexibility in design to afford the necessary range in periodicity and phase angle to meet the requirements of our laboratories. In 1909 attention of the Department was called to a motor-generator set that had been installed in the School of Technology at Manchester, England, and through the courtesy and good work of a British electrical firm, our laboratories have been furnished with these machines. So extremely useful have these machines proven to be in our testing work that no apology is made for giving a few details as to their method of construction and operation.

The set comprises two similar alternators direct driven by a continuous current motor arranged between them on the same bed-plate. The motor is a 125 volt interpole variable speed machine of 10 B. H. P. with a speed regulation of 500 to 2000 r.p.m. effected solely by variation of motor field current. The alternators are 6 pole, 3 phase rotating armature machines, and six slip rings are provided on each so that the armature coils may be connected either star or delta. The larger of the two alternators has a rating of 5 k.v.a. at 25 cycles (500 revs. per minute) and the smaller one 1 k.v.a. at the same speed, and both machines are designed to give 100 volts at this frequency. The larger machine is frequently used in conjunction with a k.v.a. oil cooled transformer giving a normal secondary load of 1000 amperes. The transformer has two primary and two secondary windings. The primary windings can be connected in series or parallel for 200 or 100 volts respectively, and in the same manner the secondary can be arranged for 10 or 5 volts.

The smaller alternator which is used to supply the pressure circuits, is also used in connection with transformers when the voltage required differs considerably from the normal voltage of the machine. The field system, or stator of this machine, has been turned so as to fit into a circular seating in the bed-plate, and by means of worm-gear may be turned through approximately 180 electrical degrees.

It is quite a simple matter to know if the phase of the voltage of the smaller machine is leading the phase of the current from the larger one or lagging behind it. By rotating the stator against the direction of rotation of the armature, the lead of the voltage is increased, or, by rotating with the direction of the armature the lead of the voltage is diminished, or the lag increased. Moreover, if any doubt exists as to whether the voltage is leading the current or lagging behind it, it is only necessary slightly to alter the position of the stator and to note the effect on an indicating wattmeter. If moving the stator against the rotation of the armature increased the reading on the wattmeter, then the voltage is lagging behind the current and vice versa.

The alternators are excited from secondary cells, and the result is a very steady supply of alternating current.

There is one other piece of testing apparatus with which our laboratories are equipped that may be mentioned and that is Dr. Drysdales' alternating current potentiometer. By those who have used the apparatus it is regarded as the summun bonum of electrical measuring instruments and when arranged to work on direct current in addition; in conjuction with a frequency meter and a standard condenser it forms a complete laboratory and will do the work of many other instruments; besides accomplishing it in a more efficient manner and obviating a number of difficult mathematical calculations, so frequent in the case of alternating currents. Alternating voltmeters and ammeters can be calibrated as in continuous current work and with a high degrees of accuracy, inductance and capacity tests can be undertaken and dialectic losses determined. Supplied with the potentiometer are two galvanometers, one of the vibration type for a.c. currents and a D'Arsonval galvonometer for direct currents.

Our laboratories are furnished with all the necessary auxiliary apparatus among which might be mentioned a standard photometer manufactured in London, England, under the direct supervision of the National Physical Laboratory authorities and furnished with a standard pentane lamp. We have also an Oscillograph for the visual examination of the wave forms of alternating currents at any phase angle or power factor that may be determined upon by means of the alternator or the phase shifting transformer connected with the potentiometer.

APPLICATION OF STANDARDS TO TRADE PURPOSES.

In May, 1895, the Electricity Inspection Act was put into force by proclamation of the Governor General in Council. It may be stated, parenthetically, that during the Session of 1893-4 the munificent sum of five thousand dollars was voted for the purpose of introducing the inspection service and with which to meet all expenditures connected with it during that year. Instruments had to be purchased, the Gas Inspectors from ocean to ocean had to be instructed how to test electric meters and lastly the modest salary of the Chief Engineer had also to be paid out of this vote. It would be unwise to weary the meeting, however, with a dissertation of the early struggles experienced in introducing the service, beyond stating that it meant working all day and travelling all night for several years, and in looking back over those early experiences the writer is amazed at, nevertheless thankful for, the uniform kindness and courtesy extended by the Central Stations of that day.

For the purpose of inspection the Dominion, from the Atlantic to the Pacific, has been divided into 21 districts, with a district inspector in charge of each district and having as many assistants as the work of the district may demand. The Dominion has also been divided into three supervisory divisions each division being in charge of an electrical engineer. In order that the working standards of the inspectors may be taken care of and periodically calibrated two additional standardizing laboratories have been established as branches of the main laboratory at Ottawa. These are located at Winnipeg and Vancouver. The department has been subjected

to some adverse criticism because of the creation of these laboratories, but it may be stated their existence is not due to any fanciful or elaborate ideas of a general lay out but to the compelling requirements of the service. Early in our standardizing experience we found that to send a wattmeter or other delicate instrument across the continent from Vancouver to Ottawa for purposes of calibration was utterly futile. The excessive vibration due to carriage by rail for a distance of 3000 miles rendered the instrument practically useless when it arrived back to Vancouver, insofar as any dependability for accuracy is concerned. We tried first to meet the difficulty by sending to Vancouver a laboratory standard wattmeter and voltmeter of the Weston make in order that comparisons might be made on the spot. This, however, did not work satisfactorily as the Standard instruments in due course required checking and so we found ourselves at the place from where we started. It was then decided to establish a fully equipped laboratory at Vancouver to take care of the far West. Later on we found that instruments sent to Vancouver or Ottawa from Winnipeg were also rendered unreliable by vibratory trouble due to long distance travel. After careful observation of the baneful effects of long distance travel on these delicate instruments we were forced to the conclusion that accuracy could not be depended upon if an instrument was expressed over a distance of five or six hundred miles. Having reached this conclusion from force of circumstances a branch laboratory to take care of the middle west was the inevitable result, hence the branch laboratory at Winnipeg. The working standards of the inspectors are sent in to the nearest laboratory for recalibration not less frequently than once in three months, and oftener if the inspector has the least suspicion that an instrument has become inaccurate.

I have here one of our Weston cells. I have brought this box along to show you how we send these cells between the three laboratories without damaging it. The Weston cell if carried right side up will be, no matter how far you send it, just as good when it reaches the end of the journey as when it started. Inside the box we have another container, fixed on a hinge like a mariner's compass, and no matter how you put the outside box, the inside one is always right side up, so that the cell is carried from one laboratory to another without being changed as to position.

As an evidence of the growth of the inspection work during the past quarter of a century it may be stated that for the fiscal year 1896-7 the number of meters tested was:—

Electricity	5,762
Gas	16,987
Total	22,749

For the fiscal year which ended on 31st March, 1921, the number tested was:—

Electricity	223,062
Gas	99,319
Total	322,381

The gas meters are here included in order to show the total amount of work done by the inspection staff. Our inspectors are qualified to test, and do test both kinds of meters interchangeably.

THE STANDARDIZING WORK OF THE LABORATORIES.

With close upon one hundred inspectors at work throughout the country supplied as they must be with standard indicating wattmeters, rotating induction meters and voltmeters in addition to voltage and current transformers, it can be readily understood that to keep these standards in thorough working condition and at all times accurate and fit for service means a good deal of work for the examiners in our laboratories.

The instruments used by our examiners and designated working or secondary standards, are mostly of the Weston indicating type and are constantly being checked up with the primary standards. By means of this frequent comparison and checking we are enabled to maintain the inspectors standards at an accuracy well within one per cent.

Now, what is desirable and necessary for our own instruments must also be desirable and necessary for the standards used by the Central Stations and the electrical industries generally. Notwithstanding this, the number of instruments received at the laboratories, other than our own, are comparatively few. Are the electrical concerns who use standards for determining the output of their plants and for their guidance generally in electrical measurements content to wander along in the dark and take a chance as to the condition of their instruments, or, are they being standardized by some unauthorized or illegal examiner.

Under the provisions of the British North America Act, Section 91, subsection 17, the subject of Weights and Measures is definitely and specifically delegated to the federal authorities. The electrical units and standards already given herein are declared to be a part of the weights and measures system of Canada which can only be administered by those designated by the Parliament of Canada. Penalties are provided in the Inspection Act against persons, other than the authorized inspectors, "who verifies or stamps or causes to be verified or stamped, or who issues a certificate as to the accuracy of any meter" and "meter" is defined as including "every kind of machine, apparatus or instrument used for measuring electrical energy or pressure".

These citations are made, not for the purpose of threatening the users of such instruments nor to induce them unduly to use the laboratories provided under the law but mainly to fulfill a duty long neglected and for which the department is to some extent responsible. A better understanding and closer cooperation should exist between the electrical companies and the department and our purpose in accepting the invitation to be present here today is that some progress might be made along the lines of fraternal cooperation.

It would seem to be desirable that a little propaganda work should be undertaken by the inspection service to overcome the deprecatory whisperings that have gone abroad with respect to the work of the laboratories and the inspection. As an instance of the ignorance that exists with regard to the

work that we are doing, permission might be granted to quote from the evidence of a Professor in one of our Universities given before the Parliamentary Committee on the need of a Research Institute for Canada. He said:

"I should like to appeal for a Bureau of Standards founded on a "modest scale to keep pace with the needs of the country. At present, "if I wish a thermometer calibrated or a set of weights standardized, "or some electrical instruments tested I must send them to Washington. "That should not be." We should have a place here in Ottawa where "such instruments could be sent and taken care of at once."

This gentleman did not know, as he should have known, that the Government of Canada shortly after Confederation fifty years ago established a system of weights and measures and deposited at Ottawa three copies of absolute standards of length, mass and capacity, and that a laboratory with the necessary equipment for making comparisons with these standards down through the years since that time has been in operation and that the system has been applied to trade and commerce throughout the Dominion since its first inception.

The same is true with regard to electricity since 1894. We can calibrate this gentleman's thermometer and check his electrical instruments just as well as they can do it at Washington, and with this advantage that the certificate we would furnish him would be valid and legal while that obtained from Washington could not be so regarded. In fact such a certificate obtained from a foreign country would have no validity in a Canadian court of law.

Under the circumstances therefore, we would appeal to the Canadian Electrical Association and the electrical industries of Canada to help us in making known the truth about the matter; and finally to assure them that we have a Bureau of Standards in fact if not in name and that we can undertake to calibrate and standardize their instruments satisfactorily and at charges that are merely nominal..

THE PRESIDENT:—I should like to submit motion of thanks to the meeting, if someone will move it.

MR. TURLEY:—Mr. Chairman, I would be delighted to move a vote of thanks to Mr. Higman. One of the main reasons I am delighted to do this is because I was responsible for suggesting to the Meter Department that they ask Mr. Higman to prepare this paper for us, principally because I was responsible for the statement that the laboratories at Ottawa were very little used, which was misunderstood by Mr. Higman. What I meant was brought out today. They are very little used by the companies of Canada. I enquired from four of the largest companies in Montreal as to what they did with their instruments, requiring tests. One sent them to McGill, two sent them to the New York State Laboratory and one to Washington, but none of the Engineers of these companies knew there was a testing laboratory at Ottawa which would do the work.

I think if this paper of Mr Higman's does nothing more than get us started to use his standardization, it will be of benefit to us all.

MR. McDUNNOUGH:—I second it.

THE PRESIDENT:—It has been moved and seconded that a hearty vote of thanks be tendered Mr. Higman for coming to the convention and presenting this interesting paper this morning. (Loud applause).

MR. HIGMAN:—I thank you very kindly.

The next item on this morning's programme is report from the Electrical Apparatus Committee, by Mr. J. S. H. Wurtele, of the Southern Canada Power Co. I understand Mr. Wurtele is not here, so Mr. Vinet will read it to us.

REPORT OF THE ELECTRICAL APPARATUS COMMITTEE.

Your Committee on Electrical Apparatus have endeavoured to keep this Report in condensed form.

Attention has been directed during the past year to more adequate protection against fires originating in units, and this has taken the form of providing:—

1. Better relay protection.
2. More fire fighting equipment.
3. In the case of Steam Generating Stations, closed ventilating-circuit systems.

As stations become larger, and are operated in parallel with other large stations, it has been found advisable to provide greater spacing between phases, in order to minimize the danger of short circuits. The most notable instances of such practice are to be found in the Calumet Station of the Commonwealth Edison Company of Chicago, and in the Hell Gate Plant of the New York Edison Company. The minimum spacing of the equipment in the former station is fifteen feet between phases. While it is not always possible to make use of out-door switching equipment in cities, the desirability of wide spacing between phases emphasizes the advantages of erecting as much of the apparatus as possible out of doors. This can generally be done in the case of hydro-electric generating stations.

With respect to failures in generating apparatus, a notable case was reported in the February 25th issue of *The Electrician*. In this instance the failure of the insulation in the armature winding of a new machine was finally traced to vibration of the end plates which held the laminations together by means of insulated bolts. The insulation of these bolts broke down and the resulting arc set the winding on fire. The repair and remedy effected by using bolts which were stressed to a low value, and were therefore independent of the natural vibratory frequency of the machine.

In connection with protection of generating apparatus it is worthy of mention that, with the increasing size of units, a few companies have decided to place electric protective equipment across the field coils of synchronous converters, to guard against the enormous voltages which may build up consequent upon short circuit conditions in the armature.

In the important matter of exciter equipment, there is evidence of greater attention being paid to the relation which the generating station bears to the transmission system and other generating stations connected thereto. A survey of recently completed Water Power Stations shows that opinion has been in favor of motor-driven exciters in stations that operate in parallel, and in such case less relative importance is attached to the water-wheel driven exciter. Motor generators in addition to water-wheel driven exciters are used in stations having two or more outgoing lines and where a single station supplies a transmission system.

Developments in connection with switching have been in favor of sacrificing flexibility for simplicity, and here again, as in the case of exciters, it is to be noted that the design of the station is closely associated with the rest of the system.

Your Committee have to report the desirability of some standard schedule being adopted for rating large oil circuit breakers as to rupturing capacity and performance. While, for operating reasons, all large companies cannot adhere to the same practice with regard to the handling of circuit breakers, a recent canvass of leading companies disclosed that the majority were in favor of the following methods of operation:—

(1) Oil Circuit Breakers connected to High Tension overhead transmission systems should not be closed after they have opened automatically until tests and inspections have been made.

(2) Circuit Breakers connected to 2300 volt distribution systems should be closed three times, at stated intervals, before leaving the circuit dead.

Thus, recent opinion calls for the rating of the High Tension Circuit Breakers based on a duty cycle requiring the breaker to be capable of being re-closed after an appreciable interval, while in the case of Low Tension Circuit Breakers, the duty cycle requires operation four times, with intervals varying from zero to three minutes. The opinion of the principal companies is that a circuit breaker should be rated at its ultimate interrupting capacity.

A failure of a large circuit breaker which had opened once on lightning discharge, and had subsequently been damaged by a further discharge while still in the open position, points to the desirability of either interlocking large circuit breakers with their disconnecting switches, or of making it an imperative order that disconnecting switches of all apparatus in damaged condition should be immediately opened.

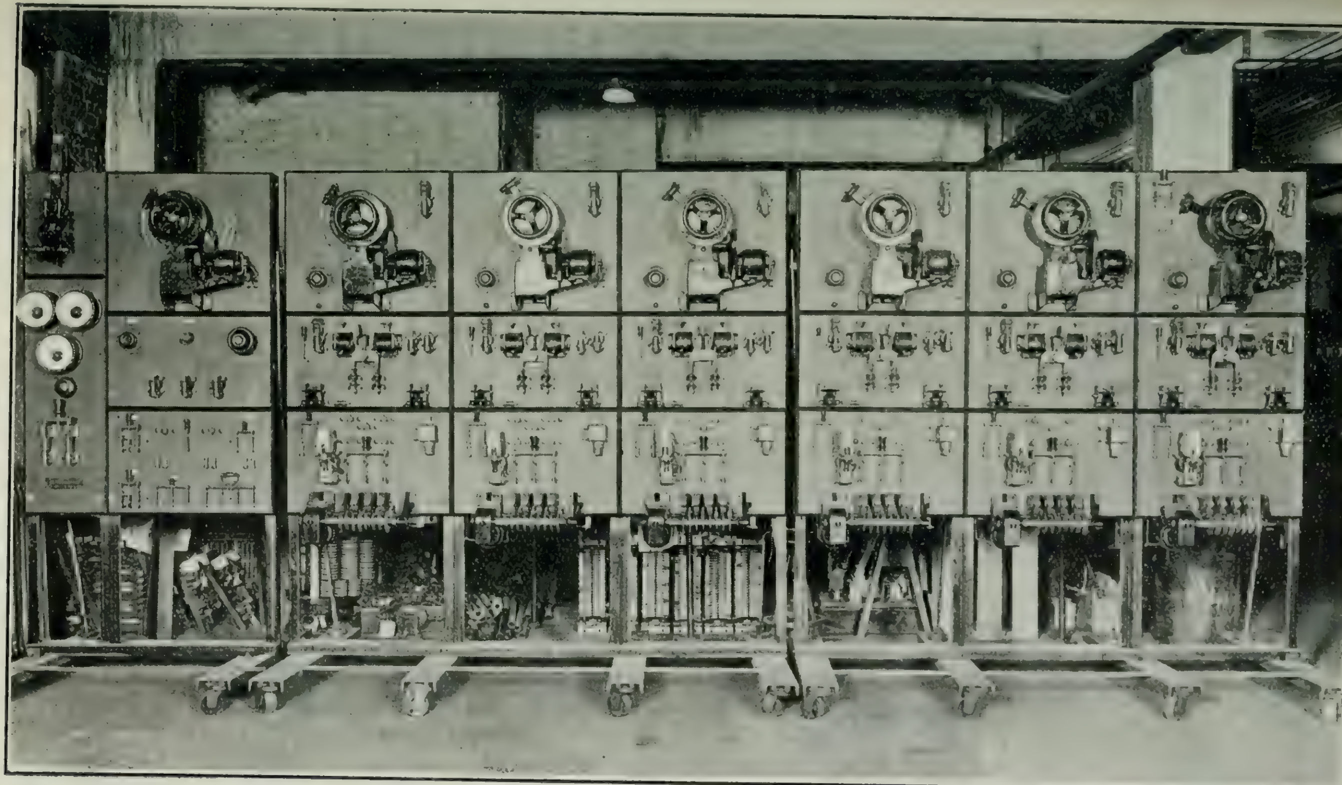
In connection with the provision of adequate capacity for high voltage testing, the General Electric Company have recently brought out a high voltage direct current testing outfit made up of a high voltage transformer connected to an ionic valve rectifier. The equipment, when connected to a 2200 volt, 60 cycle circuit, will provide a D.C. potential of 100,000 volts with a current capacity of .5 amperes.

Automatic A. C. Substations continue to gain in favour, and during the year it has been found that better operation was obtained from such substations during thunderstorms than from the manually operated substations.

In the past year one company in Canada has installed a bank of three 13,200 volt, 1250 K.V.A. water-cooled transformers out of doors. The transformers rest on a concrete vault which contains the water piping, and is readily kept at a safe temperature. This company maintains that with water-cooling coils arranged for thorough self-draining and brought out vertically through the bottom of the transformer case, the matter of protection of the cooling-water system against weather hazards becomes comparatively simple.

An effort is being made to standardize service voltage, and the majority opinion of member companies appears to be in favour of voltages between 115 and 125 at the consumers' entrance switch.

Of general interest in the field of industrial equipment is the recently developed sectionalized drive for paper-making machinry. This has followed the demand for high-speed paper machines consisting of many individually driven units of different speeds, the relation of which to each other does not change, as against the single unit type of machine heretofore in use. The Canadian Westinghouse Company has recently installed such a machine in one of the plants of the Abitibi Power & Paper Company. Each section is driven by a direct current motor through a flexible coupling in the case of high-speed machines, but if applied to low-speed machines the connection between motor and drive is through a reduction gear, each end of which is flexibly coupled. Each one of these sectional drive motors is in addition connected by a chain drive to a slightly tapered conical pulley, which is in turn connected by a belt, capable of very accurate adjustment by means of a hand wheel, to a complementary conical pulley driving a small frequency generator. Each of these small sectional frequency generators has its frequency balanced against the frequency of a master or control frequency generator by a powerful rotative relay which actuates two pairs of disc contractors. As soon as there is any change of speed between sections or between any section motor frequency generator and the master frequency generator, an unbalancing of frequencies results, which is instantly transmitted to the rotary element, producing movement in one direction or the other, and thereby through the contact-making mechanism operating the section motor field rheostat, and correcting the sectional change of



(Fig. 3)

speed. An anti-hunting attachment prevents a tendency to over-travel. The speed of each section is constant with regard to the motor controlling set but it is capable of individual adjustment by the hand wheel and pair of cones, so that the required amount of draw may be obtained. All of the motors are driven from a direct current, adjustable voltage generator, with a separate constant voltage exciter capable of furnishing excitation for the synchronous motor fields, the motor fields, and the various control circuits.

There is a switchboard, illustrated in Fig. 3, consisting of master control panel, and separate section motor panels, with push button control which may be in multiple with other push button stations for convenience in operation. All rheostats controlling speed are motor-driven and the entire equipment is automatic, subject only to relative section speed adjustments by hand wheel and to control as a whole, or individually, by push buttons as before stated. We are indebted to the Canadian Westinghouse Company for the illustration herewith.

The problem of inductive interference enters the field of your Committee, and is becoming more and more important as networks are becoming larger. Experiments have been made with the ordinary well-known auxiliary bank of transformers, and with transformers having tertiary windings. It appears that in order to be effective in suppressing the third harmonic, the corrective apparatus used should have a K. V. A. capacity comparable with the main bank of transformers. This can probably be most cheaply and effectively obtained by using a delta interconnected-star connection of the main transformers with the delta on the station side.

Respectfully submitted.

M. J. SCHWEGLER.
R. J. EVEREST.
J. S. H WURTELE, *Chairman.*

THE SECRETARY:—I beg to move the adoption of the report.

Seconded by Mr. McDunnough.

THE PRESIDENT:—It has been moved and seconded that this report be adopted. Any discussion?

THE SECRETARY:—Mr. President, I have a written discussion from Mr. Morse, General Superintendent of the Shawinigan Company.

MR. J. MORSE:—(Written) The report refers to a statement concerning two circuit breaker performances which in the writer's opinion requires further discussion.

The Committee has divided the high tension and low tension circuit breakers into two classes.

In this classification the breakers on the high tension line require testing and inspection after each automatic operation whereas the low tension breakers must be suitable to perform a duty corresponding to three times the amount of work in proportion to their respective ratings than the high tension breakers. This suggestion of rating leads one to believe that either the high tension breakers do not require to come up to the same standard of service as the low tension breakers or that they cannot be supplied by makers to perform this duty.

In the transmission of power, high tension circuits are more important than a circuit of low voltage owing to the greater amount of energy transmitted and greater number of customers to serve. A slight delay in restoring service is, therefore, often more serious when occurring on high tension lines than on low tension circuits. It is desirable, therefore, that the breakers controlling these lines should be selected so as to harmonize with the installation as a whole for the sole purpose of providing best operation and service reliability.

When one considers that about 60% of all total interruptions to high tension transmission lines on the Shawinigan System are of a momentary nature so that the lines can be immediately put back into service, it is evident that the circuit breaker should be capable of sufficient rupturing capacity to allow the immediate reclosing without inspection.

It appears to the writer for the above reasons that one schedule of performance embodying all circuit breakers would be sufficient and might be formulated as follows:—

"It is understood that the rupturing capacity of the oil circuit breakers is the ultimate capacity which the breaker is able to rupture twice in rapid succession without sign of distress or spilling of oil to any appreciable extent."

It would then be left to the Operating Engineer to determine on his part the operating conditions required in each particular case, and if more severe than specified in the standard rating a correspondingly heavier duty switch would have to be chosen to correspond with his modified requirements.

MR. O. V. ANDERSON:—I may say that at the Chicago Convention, it seemed the consensus of opinion of the engineers present that fire crackers were not wanted on the system. The general opinion is that you want breakers that will operate twice and be able to operate third time non-automatically—to cut off normal current. What is the use of a breaker you can't take out again for inspection after normal cycle of operation? It seems to me a step in the wrong direction to put in an expensive fuse and call it a breaker.

MR C. R. REID:—I would like to add a little something to what has been said in favour of a breaker that can be closed in immediately. On the Shawinigan system we have some lines which are operated two lines in parallel on the double line protection, and it is our practice when one line goes out due to lightning, as they frequently do, to close in the line again immediately. Sometimes it is a sort of game between the operators and the lightning to see if service can be maintained. Perhaps they will close in one line and immediately the other one will pop out. That can be closed in again at once, and so on; and it is thus possible that we maintain service over two parallel lines by keeping one of them continuously in.

MR. J. S. RIDDILE:—I should like to add a word or two along the same lines as Mr. Morse's discussion and those of Mr. Anderson and Mr. Reid. We are connected to the Shawinigan system and at the present time have five 60,000 volt lines running out of our station. Our experience has been much the same as Mr. Reid has outlined his.

It seems to me if you have a breaker that can be opened automatically only once then you must have a duplicate switch system for each line. High tension rooms are pretty well filled up with everything now, so much space is required for bus bars, etc., that to introduce two circuit breakers for each line is going to run to very great expense for building as well as for equipment.

As everyone knows, if your breaker opens and you close it back immediately you get one result. If you allow some time, say one-half, one or two minutes, or whatever may be found best by experience, you may get another result. If your breaker opens up a half dozen times in succession and then is closed after a few seconds, or even a minute, you are liable to have something serious happen. Gas explosions can be largely eliminated, of course, by closing the breaker after a longer interval, especially after the first or second interruption. At some power stations there have been installed means for exhausting gases or vapors from the oil switch and allowing a new supply of air to enter. In some ways it has appeared that this scheme has not been worked out to a best final result. We all know that we get our best gas engine performance with a mixture of air and gas combined in fairly definite proportions.

It seems to me that the experience of a great many of us has been that we can do a great deal more than has been recommnedd in this report in the case of large high tension systems.

Another point in the report is the suggestion of having disconnecting switches interlocked with the circuit breaker. This is a point that has never occurred to me before in connection with work of this sort. Offhand, it looks like a rather large contract. I have little doubt it can be worked out but whether practicable commercially it is difficult to say.

In connection with a further feature of the report, it may be of interest to the members to know of an existing installation, which has been discussed somewhat in the technical press but not mentioned here, of an interlocked drive for paper machines; that is, driving each section of a paper machine with individual direct current motors, and having automatic control to maintain the speeds of the different sections in their proper relations.

At the mill of the Laurentide Company, Limited, last winter we installed two new paper machines with a drive of this sort but working on a considerably different principle from that described in the report under discussion. In the end the same thing is done through automatic control of the fields of the individual motors but the means by which this is accomplished are different.

This drive has been very successful and the machines are operating at speeds pretty well up to what they had been designed to furnish. We have two machines running at 870 feet per minute and one of them has operated successfully for a considerable period at 950 feet. We expect to reach 1000 feet per minute and hope for a great deal more. There are few, if any, other news machines running at speeds much in excess of 700 feet per minute.

The drive discussed in the report accomplishes its control entirely through electrical means. Instead of this, ours is largely electrical, although the essential regulating means is a differential gear. Each individual drive motor for a paper machine section has one of these differential gears. One end gear of the differential is driven from a line shaft, the speed of which is maintained constant. The other end gear of the differential is driven by the motor that drives the particular section of the paper machine. The pinion, or the intermediate gear, of the differential will revolve only if there is a a difference of speed between the two end gears and if such a difference exists the speed of the intermediate gear will be one-half the difference in speed of the two end gears. To this intermediate gear we attach the field rheostat arm of the section motor and thus automatically correct any tendency to change in speed so that instead of having an actual speed change measured in revolutions, there is a small angular change. Before and after this slight angular change, the intermediate gear, and thus the rheostat arm, remain fixed in space and indicate that there is no actual difference in speed between the motor and the constant speed line shaft. The correction of *tendencies* for change in speed is accomplished by the rheostat arm, when it moves through the small angle mentioned, increasing or diminishing, as the case may be, the amount of resistance in the motor field circuit. It is a simple matter, of course, to have the connections such that a tendency towards increase in speed will be annulled by decreasing field resistance and vice versa.

The drive equipment which I have briefly described is of English origin and manufacture. It was supplied by a Canadian Company, namely, The Harland Engineering Company (of Canada) Limited.

The slogan of electrical people is "Do It Electrically". I hope I have not intruded upon the spirit underlying this in taking up your time in describing an electrical equipment which is so dependent upon a mechanical device for the essence of its control.

THE PRESIDENT:—Any further discussion?

MR. WILLS MACLACHLAN:—Another point in connection with electrical apparatus, I would like to draw your attention to the habit of certain manufacturers to put blocking in apparatus in shipping. As you well know, there have be n some serious accidents due to the non-removal of blocking from electrical apparatus, and I would suggest, the desirability of putting a distinctive sign, tag or otherwise, on the outside of the apparatus, calling the attention of construction men to the blocking that is inside. As we well know, fourteen men were killed during the year, possibibly due to non-removal of blocking from a piece of apparatus. This happened in the United States.

Another point, due to the fact of the interconnecting of large systems to smaller ones, great care should be taken to see that the switches, particularly the oil switches at the interconnection, are quite capable of handling any of the larger blocks of power that might go into that station, due to increased generator capacity on short circuit. There have been instances in the United States of smaller system connected to larger ones, causing explosion of the oil switches..

THE PRESIDENT:—We are grateful to Mr. Maclachlan for mentioning these two points of considerable moment.

It has been moved and seconded that this report be adopted unanimously.

Before closing I would like to say that the afternoon's session begins at 2.15, when we are to hear a paper from Mr. Anderson of the Overhead Systems Committee.

I feel sure that you will agree with me that this has been an exceedingly interesting discussion, and that the interest of the Convention will increase from day to day.

WEDNESDAY AFTERNOON, 2.15 P.M., JUNE 15th

THE PRESIDENT:—Gentlemen, will you please take your seats. I call the meeting to order.

The first item on the programme is report from the Overhead Systems Committee, to be read by Mr. O. V. Anderson, Toronto Power Company.

REPORT OF THE OVER SYSTEMS COMMITTEE

Mr. President and Members of the Canadian Electrical Association,—

The report of the National Overhead Systems Committee of the National Electric Light Association, with which we are affiliated, deals with matters of considerable interest to the Geographic Division and Allied Societies. This report will be in the hands of all the members of the C. E. A., and such parts as are of special interest to this Association may be read at this time. The report of your Committee, therefore, deals only with such other matters which are of special interest at this time to our own members.

Your Committee is represented on the National Committee at this time by the Chairman and one other member of this Committee. Three meetings were held by the National Committee, two of which were attended by the representatives and therefore closely in touch with the work.

The present organization of the N. E. L. A. into many Geographic Divisions makes it more possible for the Divisional Chairman to become thoroughly acquainted with the systems in use and the needs of the members in their respective Divisions. The current practice and progress made in any line, can be better determined and reported, because the Committee can direct questionnaires necessary to obtain the required data to the Companies that are interested and able to supply the information, thus obviating questionnaires being sent out broadcast, unnecessarily bothering Companies which obviously cannot supply the required data.

Your Committee suggest, therefore, to its successors that they become fully acquainted with the conditions within the area of their jurisdiction, and thus be better able to serve the Association.

Shortly after the formation of your Committee, a meeting was held in Montreal to consider matters which seem of special interest at this time. As a result of this meeting a questionnaire was sent out. This report deals with the deliberations of the Committee and the replies to the questionnaire. Your Committee wishes to thank the members for so generously replying to the questionnaire.

Mr. Davies, of Montreal, asked the Committee to report on the advisability of using bare wire for primary circuits. Your Committee directs your attention to a report of a previous Committee on this subject two years ago against the use of bare primaries. This decision the present Committee fully endorses. One added reason for this decision, which the former Committee did not bring out, is that while the insulation is not of much value as such, yet under certain conditions it has proven valuable in preventing injury, and it is also desirable from a legal point of view, since it shows that we have at least taken some precautions to prevent accidents. This Committee recommends the continuance of the use of insulated wires in urban areas.

The Canadian Electrical Association was asked to appoint a representative to the Sub-Committee of the Canadian Engineering Standards Association on Pole Specifications. In order that the Overhead Systems Committee be in touch with the matters dealt with by this Sub-Committee, the Chairman of this Committee was appointed as the Canadian Electrical Association representative.

The questionnaire included requests for data on pole specifications. Replies to this part of the questionnaire were received from twelve Companies; four reported that they buy poles under the N.E.L.A. specifications, and eight that they do not; ten desire modification in the specification, two do not; eight buy under their own specifications, which are modified N.E.L.A. ones, Cedar Association or by inspection; four do not have their own specifications.

The replies on these points indicate the desirability of a change in the N.E.L.A. specifications. The Committee will be enabled to get in touch with the various Companies desiring a change, when the matter comes up for consideration from time to time in the Canadian Engineering Standards Association Sub-Committee.

Your Committee has discussed the desirability of perfecting some device which would be more economical and also more definite in indication of Overhead than the present practice of testing transformers at various intervals or keeping track of the connected load. Several expedients such as wax tubes, thermometers placed in the oil, heat-indicating paints, etc., were studied, and it was found that results obtained from these devices were not entirely satisfactory, and the readings were rather inconvenient to obtain. Two devices were exhibited before the National Committee at two of their meetings, which your Committee hope to be able to have shown at this Convention. These devices are easy to attach to a transformer, operate on predetermined temperature of the oil, and give a positive indication of the oil having reached this temperature. It is the heat of the oil after all that indicates whether or not the transformer is being operated at a safe load. A section of transformers equipped with such a device can be readily and quickly

inspected for overload. When a transformer is found to be overloaded, further readings can be taken in order to determine time and length of such overload. Your Committee has received circulars of devices which indicate a predetermined current passing. They do not take into account the temperature of the surrounding atmosphere and are not what is required for transformers that are located out in the systems.

In regard to the standardization of line material, the Companies replying were of the opinion that these materials should be standardized. Your Committee has asked that the Canadian Engineering Standards Association be approached for the purpose of appointing a Sub-Committee to take up this matter, because in this way it would be possible to get all interests together and obtain more general standards. Your Committee in reviewing the matter are of the opinion that the materials only should be standardized, each Company should be left free to assemble and combine these materials in forms most economical and adaptable to the Company in question. We understand that the Canadian Engineering Standards Association has now appointed a Sub-Committee as requested, to deal with the matter.

The replies in regard to the insulator situation do not suggest that it is feasible at this time to do much in the way of standardization. The report of the National Committee deals more fully with this matter.

No particular trouble is reported as being experienced due to furnace load. Such loads are for the most part special and have to be dealt with as they come up. If any member has any special difficulty with furnace regulation, the Committee will be pleased to study the matter and present what data it can on the solution of the problem. The usefulness of the Association can be greatly increased by sending your problems to the secretary of the Association for presentation to the Committee dealing with that matter. The Committee will appreciate having matters brought to their attention.

The topic that entailed the most interested discussion was the question of the ability of the Distribution System to carry range loads, and heater loads, and what was necessary in the way of extra equipment to carry any amount of this class of load. Due to inexact knowledge as to the character of the load imposed by ranges, the practice in regard to transformer capacity and chopper for carrying the load is quite varied among the Companies.

It was thought that a suitable device that would indicate overload on a transformer was of prime importance, because then the various practices could be checked up and transformers of the correct size could be installed.

Your Committee endeavoured to collect data from various sources as to the actual characteristics of the range load. Due to the war and the curtailed amount of power for sale for such use, the sale of these devices were not pushed, and the larger Companies did not spend any great amount of effort to get data. We were, therefore, unable to get any recent data.

The 1917 proceedings of the N.E.L.A., Report C-19 of the Commercial Section, contains as complete a report as has so far been gotten out. This report does not cover a great variety of communities. The habits of a community largely determine the characteristics of the range load, so that a proper solution is not obtainable unless these characteristics are known. Your Committee cannot give a solution which will be applicable to every community, and can only indicate lines along which the solution may be worked out, from factors which seem to be constant in the various communities.

The Society for Electrical Development publishes a book which contains a great deal of information with respect to the range load. This data is based upon the findings of the 1917 report noted above.

Recently an article appeared in the *Electrical News* on the economical handling of the range load, which was one of the subjects of a convention held in Toronto.

A review of the above, and a number of other papers supplied by the Service Department of the N.E.L.A. headquarters, indicated that the maximum demand to be expected from any range is approximately one-half the connected load of that range. This demand seems to be generally accepted as correct.

The reports also indicate a 10% drop in the normal range voltage, that the time for the oven to reach operating temperature is increased by 75%, while the K. W. hours consumed in obtaining this temperature are increased by 16%. Good voltage regulation is then very desirable and in order to have satisfied customers and the most economical use of the power supplied, the voltage must therefore be kept within a range of not over 5% drop from the normal range voltage.

The problem of one range is to provide transformer capacity for one-half the connected load of the range and run copper between the transformer and the range so that the drop will be within a limit of 5%. Whether this transformer capacity has to be provided over and above that required for the lighting demand, or whether the lighting transformer can be used wholly up to its capacity for range load will depend upon the characteristics of the community served. In large centres where the evening meal is the big meal of the day, the demand in the winter months coincides with that of the lighting demand, so that transformer capacity will have to be supplied for taking care of the combined demand of the range and the lighting. In the smaller communities, where the noon meal is the big meal of the day, the maximum of the range comes nearer noon and can be nearly disregarded as far as the lighting peak is concerned so long as the range demand is below the lighting demand at night. If the range demand is the dominant factor transformer capacity will have to be installed for that demand, which is the greater.

When more than one range is connected in the same vicinity with another range, the opinion and findings as to the relation between the demands of the ranges diverge widely. Reports are agreed in that there is a considerable diversity between ranges. That this diversity is generally true for each day is not shown, or the possibility of there being some days when the diversity would be a great deal less. At a recent discussion of the diversity between range demands, tests were quoted that showed that although the diversity was great part of the time during the week, that a maximum demand of one-third of the connected load could be invariably expected from a group of scattered ranges, usually on the same day each week.

The replies to the questionnaire indicate a considerable variation in practice, but the general practice coincides with the above findings.

All of the Companies except one, replying to this part of the question, use the same transformer for lighting and range loads.

Reported transformers capacity installed for ranges varied from capacity equal to that of ranges connected to transformer capacity of one-third the connected load of the ranges, the latter practice being the most prevalent.

In some cases this transformer capacity takes no account of the lighting load that has to be carried as well.

The opinion as to what part of the range demand might be expected on the lighting peak varied from full-range demand to one-sixth of the range peak.

The recommendation of your Committee as a safe practice from the experience of the reporting Companies is to provide a transformer capacity of one-third the connected load of the ranges to be supplied, and to install copper between a transformer and a range to give not over 5% drop for one-half the connected load of that range. Where the lighting load and the range load peaks come on the system at the same time, the transformer capacity needs to be increased as above to take care of the load, but where the range peak comes during the morning or noon the transformer capacity need only be provided for the range load and not to take into consideration the lighting load.

In all probability taking care of range loads will involve changing the secondary lines in portions of system where ranges are installed. Your Committee wish to call your attention to a report in the 1914 proceedings, (Technical Sections, pages 655 to 682), which gives a plan for figuring cost of your own system, you will be able to determine whether or not it will be more economical to survey the sections and rebuild your lines for a load to be expected in a certain period of years, rather than to rebuild your lines each time a range or ranges are added. One of the hardest factors the Distribution Department of any system has to contend with is to have the Sales Department and the Company as a whole to realize that after all it is the most economical thing to built up a section for an expected load, and then go after the business and load up the lines, not to load up the lines and rebuild as the load comes on.

On most systems study along these lines, making the Sales Department obtain the expected business, rather than have the Distribution Department lag behind, delaying the increasing of the lines until the load has grown, will be found to be the most economical solution.

Respectfully submitted this 15th day of June, 1921,

O. V. ANDERSON, *Chairman.*
R. B. MCDUNNOUGH.
A. A. DION.
G. M. ANDERSON.
L. A. KENYON.
R. D. HARKNESS.
JOHN ALDEN.

MR. ANDERSON:—As stated previously we had expected to have copies of the main Overhead System report at the Convention, because it deals with matters of considerable interest to us. Mr. Beaumont touched slightly on the report. The following is a short resume of the report which may lead to discussion.

RESUME OVERHEAD SYSTEM REPORT N.E.L.A.

Overhead Lines Committee of previous years, dealt mainly with construction topics and problems. The Committee of this and last year has introduced subjects dealing with operation and maintenance of the plants.

The plan of the work for succeeding years is to develop the progress in practice of the various companies from year to year, so as to form a continuous outline of this work.

The subjects covered in this year's report are shown in the table of contents. It will be necessary to take considerable time to thoroughly digest this report. For purposes of probably developing interesting discussion, and also to indicate lines of work which we suggest that the succeeding Committee take up, a copy of the report has been placed in your hands.

One particular thing to note is that the Overhead Systems Committee has expanded its work to include transmission lines, previously problems of distribution were mainly studied.

WOOD POLE TRANSMISSION LINES.

No endeavour has been made to formulate a specification. Presentation of data, describing present practice together with opinions of leading engineers as to certain features makes up this part of the report.

An interesting chart is shown on page eight, which indicates the rise in transmission in voltage. Page twenty two shows a method of overcoming the strain on suspension type insulators removing a cause of main failures.

OVERHEAD GROUND WIRE AND GROUND NEUTRAL CONSTRUCTION

On account of present cost all parts of the system justify their continued use.. The use of the ground wire, and the use of wood instead of steel crossarm was studied to see which is the most desirable practice. The report analyzes the replies to a questionnaire sent out on the subject.

INSULATOR MAINTENANCE.

The chief item of interest is the report of the co-operation of the Committee, the Standards Committee of the A.I.E.E. for the joint development of insulator specifications.

An item of considerable interest and discussion was the rating of the insulators. It is felt by many companies that the present rating in line voltage is misleading, and that the rating should be made in dry and wet flash over, allowing the engineer to select the proper factor of safety. It seems that the opinion is devided into two classes, that of distribution line insulator users, and that of transmission line insulator users, and a classification may be necessary for each.

SUSPENSION INSULATOR RESEARCH.

This reports the method and materials used in making the analysis. Stereopticon pictures were shown of another series of test, indicating that voltage has gotten to the point, that it is not any longer a question of insulator failure, but failure of the dielectric surrounding the wire.

FARM LINE CONSTRUCTION.

A problem of cheaply supplying the farm load with safe lines is before us. There is a possibiilty of developing considerable load in this field. The Committee makes no recommendation but suggests a line sufficiently rugged yet inexpensive. A lower factor of safety can possibly be used, because of the lightly loaded lines.

LINE CONSTRUCTION MATERIALS.

This is a continuation of specifications shown in the hand book, showing modification and new practice. Standardization is of importance to secure low cost and quick delivery for required articles. A table of sags is given for copper clad wire.

REVISION OF WOOD POLE SPECIFICATION.

This gives material that will be of considerable value to the Overhead Committee in continuing its work along with the Canadian Engineering Standards Association.

One point that may be made mention of, that has previously not had proper attention is that butt dimension determines the strength of a pole, and not the top dimension.

PRESERVATION TREATMENT OF POLES.

A very comprehensive report is made in this subject, and one that should be studied with interest. The new process of perforating the poles for treatment is fully described. By this method it is possible to get uniform penetration.

Service tests of poles are given by R. R. Hicks of the Forest Products Laboratory.

The report is followed by a set of specifications for preservation etc., that will be very useful.

Short articles on the use of Concrete poles, for distribution lines, lighting arrester practice and operation and maintenance of transformers, are of some interest.

AUTOMOTIVE EQUIPMENT AND LABOR SAVING DEVICES.

This part of the report is of exceeding interest. In order to make the report as valuable as possible, each member company should send in their developments in this line, so as to have a complete survey of this most interesting part of operation of system.

MR. ANDERSON:—Mr. President, I move the adoption of this report.

THE PRESIDENT:—Will some one second the motion?

Seconded by Mr. Davies.

THE PRESIDENT:—It has been moved and seconded that this report be adopted.

MR. J. H. TRIMINGHAM:—I think that we are giving the general public a false sense of security by insulating the 2200 volt circuit. When one sees power lines operating at voltages of 6600 and 13,000 carried through towns and villages on bare wires, the impression left on the public mind must be, that it is safe to touch an insulated wire. Undoubtedly a great many acci-

dents result from people touching insulated wires which are lying in the street, as a result of severe sleet storms. I know of one instance where a wire had fallen in the street, and when a man was told not to touch it, his reply was: "Why, that wire is insulated." It is such remarks as that that create the belief that the public are living in a false sense of security.

THE PRESIDENT:—A very interesting point. Does anybody else want to deal with that or any other point?

MR. MACLACHLAN:—There is one point that I would like to ask Mr. Anderson. In the second paragraph of page 56 he touches on the point that the materials entering into line construction will be standardized by a special committee of the Canadian Engineering Standards Association, but that the form of fabrication of the overhead system will not be standardized. I wonder how it is possible to standardize the pieces going into this overhead structure without standardizing to a certain extent at least, the type of construction to be used, as if you vary the type of construction you must certainly vary the materials.

MR. ANDERSON:—We use practically N.E.L.A. standard materials. We however combine these materials in forms not generally used by other Companies. I am speaking particularly of the "A" frame construction, with ground wire on top, with phase wire 1, 2 & 3 on each side of pole, two wires to the arms so as to form an "A" shape construction. Some Companies use 8 and 6 pin arms on alley construction, that is all of the pins on one side of pole. It does not seem very desirable to attempt to limit the way materials are used, rather to limit the number and shape and dimensions of articles used. These articles to be used on standard clearances and strain ratings. By reducing the stock of the Manufacturers to fewer articles we will reap the benefit in reduced costs.

MR. MACLACHLAN:—It will be necessary to have question of clearance defined.

MR. ANDERSON:—Yes.

MR. DAVIES:—The question came up on Mr. Beaumont's paper of longer spans, and was not taken up this morning. Perhaps Mr. Anderson has something to say on that. I would like to know what the tendency is towards the use of longer spans.

MR. ANDERSON:—In the main Overhead Systems Report, copy of which I am sorry we were unable to place in your hands, under the topic of Wood Pole Transmission Lines the subject of spans is discussed. The span length is increasing, the span of 110 to 115 feet is now 200 to 500 feet, reducing number of insulators and points of failure.

At the Chicago convention a demonstration of the installation of a service was given by three competing gangs composed of two linemen, a groundman and a foreman. Their problem was to erect a transformer, connect it, run service, connect it, solder and tape all joints. Time limit 16 minutes. For each second cut off this time limit the gang that won would get $20.00 extra. The winning gang installed the service in 13 minutes and 40 seconds. I wonder how many of our service gang could compete with that record.

THE PRESIDENT:—We are all greatly interested in this paper given by Mr. Anderson, also the discussion. I don't know whether it is my place to do so, but it seems a pity if those who are interested in specific points do not avail themselves of the opportunity of meeting the other members, not only

at the meetings but in moving about in the halls, because obviously the experiences of the various members vary very much. It occurs to me that one of the great advantages of the Convention is to get together and exchange experiences one with the other.

The next item is report from the Commercial Section, to be read by Mr. Gilman.

REPORT OF COMMERCIAL SECTION 1921

To the President and Members:—
GENTLEMEN:—

INTRODUCTION

This year marks the beginning of a considerable change in the committee organization and work, both of the Canadian Electrical Association and of the National Electric Light Association, as stated in the Secretary's report.

However, conditions in Canada differ quite considerably from those existing in the other Geographic Divisions in the United States. Accordingly, it was felt, in the case of your Commercial Section, that the interests of the Canadian Electrical Association, for this year at least, could best be served by eliminating certain refinements of the committee structure within the N.E.L.A. Commercial Section. By combining the functions of several of their Bureaus and Committee into one of our Committees, it was believed

that expense to our Member Companies would be reduced without any decrease in the actual volume of work accomplished.

Hence, in forming our Commercial Section, your Chairman appointed members to represent the Canadian Electrical Association only on the following Bureaus and Committee of the Commercial Section, N.E.L.A.: Power Sales Bureau, Lighting Sales Bureau, Merchandise Sales Bureau, Education Committee.

Your Section, as a unit, has kept in touch with the committee work of the remaining Bureaus and Committees of the N.E.L.A. Commercial Section listed as follows: Advertising and Publicity Service Bureau, Electric Vehicle Bureau, Commercial Service and Relations with Customers Committee, Compensation of Salesmen Committee, Electric Salesman's Handbook Committee, Finance Committee.

After holding several meetings throughout the year and being represented by two of its members at each of two of the Executive Committee Meetings of the N.E.L.A. Commercial Section, your Commercial Section respectfully reports as follows:—

POWER SALES BUREAU.

Because of the general business depression which began in the fall of 1920, and which only now is showing signs of a return to a more normal state, certain of our Member Companies have noted a considerable change in the volume of their power sales. Not only has there been a decided lessening in the number of applications for new services, but also a general reduction has occurred in the use of power on the part of existing customers.

This lessening in central station output has come at a time when operating expenses are at the highest level ever known. The consequent reductions in net revenue in some instances have been of serious moment to our Member Companies, faced as they are with the contract obligation of maintaining their power supply to existing customers during a time of business depression to the same extent as called for during periods of normal usage.

Your Bureau accordingly recommends most strongly for our Member Companies to give their careful consideration to the subject of MINIMUM GUARANTEE CLAUSES in the contracts for power service that come up as renewal of existing business, or as new business. Is the present form of contract such as to afford the revenue required to carry the heavy fixed charges incident to supplying the service normally demanded which service possibly under present extraordinary conditions, may not be desired by the customer for months at a time? Now that our Member Companies have made the investments required to supply such service, it is obvious that full justification exists for us to stipulate a sufficient minimum monthly return to cover the full expense of maintaining our service in readiness to supply, regardless of whether or not this service is demanded continuously by our customer.

This necessary protection may be secured in various ways: by a flat rate per horse power per year or by a combined service charge, plus meter rate, with a monthly minimum payment based upon the amount of service contracted for or upon the maximum demand previously established. Your Bureau hesitates to recommend any particular arrangement, but has incorporated later in this Report a summary of replies to a Questionnaire from many of our Member Companies, which it is felt will partly answer this question.

Operating conditions on the part of many of our power customers during the past six months or more, have been such as to cause unsatisfactory conditions of low power factor on certain of our Member Companies' circuits. This subject of low power factor operation, however, has been treated quite exhaustively in previous reports to our membership, and your Bureau does not intend to touch this important subject further than to recommend that our Member Companies incorporate suitable clauses in their contracts to guard against such needless operation by their customers. Typical Power Factor Clauses, as used by certain of our Member Companies, are listed in the Questionnaire for the convenience of our members.

No outstanding new development in the line of electric power application has come to the attention of your Bureau during this year.

Several customers of our Member Companies have installed, and others are now investigating, the merits of electric furnaces for the melting of non-ferrous alloys. The development of such furnaces has progressed steadily during the past few years, and there are now a number of well-known makes on the market, principally used in the production of nickel alloys, brass, bronze, copper, aluminum and platinum. These furnaces are generally of small capacity, about one (1) ton or less per heat, and operate on single phase circuits as a rule, with requirement for from about 150 to 300 Kilowatts per ton of capacity.

Such furnaces are becoming in quite general use in brass foundries, and deservedly so. With their use, labor costs are lowered, particularly if the furnaces are supplied with automatic control. Melting costs are a function of the price of power, continuity of furnace heats and of the thermal efficiency of the heating medium. With the present high fuel prices and the reasonable rates for electric service, the melting of brass in electric furnaces will be found to be cheaper for our customers as a rule. Because of the larger melts, as well as the more intimate mixture obtained by the use of electric furnaces, the quality of brass from an electric furnace is probably more uniformly good than that obtained by the older methods.

Another electric furnace development recently has been the production of malleable iron in a three-phase arc type furnace. The manufacturers of this furnace claim the very important advantages of more correct analyses being obtained; better temperature control; higher yields of better castings; reduced production costs and less skilled attendance required. Your Bureau has no personal knowledge of any installation of such a furnace, but believes, in view of the admitted under-production of malleable iron in Canada, that this process is very worthy of careful investigation, with a view to the possible establishment of such an industry in some one of our centres.

LIGHTING SALES BUREAU.

One of the principal features of this year's activities of this Bureau has been the establishing in a number of the larger cities of the United States of a remarkably successful Industrial Lighting Exhibit, designed to educate the public to the economic necessity of adequate illumination. Your Section hopes that this Exibit will later be shown in some of our Canadian cities.

Business depression has partly relieved the serious power shortages that existed in certain sections of the country. This relief has permitted the resumption of display lighting, window and sign lighting, etc., with great satisfaction both to the merchant and central station.

Continued use is being made of the high efficiency lamp, suitably protected by shade or globe to guard against eye strain from undue glare. As in the case of the substitution of the tungsten lamp for the inefficient carbon lamp, the individual use of lighting has been extended sufficiently to counteract successfully, the lessened consumption of electricity due to the more efficient illuminant. This type of lamp is now being utilized more and more in the home, due to the smaller size of lamp and to the improved shades that are available now.

The "Day-light" lamp continues its popularity in stores where accurate color matching is required to be made under conditions closely approaching natural lighting values. Its use in the home has not become of any consequence as yet, because of the present high cost of such lamps and their high current consumption per unit of candle power delivered.

With the recent lowered labor costs some of our smaller municipalities are now proceeding to change their existing street lighting installations to the modern type of nitrogen lamp. Your Bureau recommends for all reasonable encouragement to be given to such changes, believing in a small community that no single feature stands out more prominently than a pleasing system of street lighting. Further, it is a fact that the use of modern street lighting educates the people in the community to the value of adequate lighting in their homes, and helps thus to increase the number of lighting customers on the system.

MERCHANDISE SALES BUREAU.

To counteract the "buying strike" which has been in effect during the past winter and spring, certain of the Merchandise Managers of our Member Companies have placed emphasis on the fact that a number of the more popular appliances: electric irons, vacuum cleaners, washing machines, etc., are articles of absolute necessity in the household wired for electricity and in no way should be looked upon as articles of luxury.

Because of the reasonable and necessary price advances of most electrical appliances, their sales have not been curtailed as much as some other lines of merchandise. However, there has been a falling-off in many cases over the average of former years, and certain of our Member Companies have lessened the burden to the customer on such purchases by adopting a more generous system of deferred payments on the more expensive articles.

A development which may prove of considerable benefit to this branch of our activities, is the contemplated investigation by the Harvard School of Business Research into the methods under which electrical merchandising is now carried on. Following the voting of money to defray expenses by the N.E.L.A., The National Association of Electrical Contractors and Dealers, Electrical Supply Jobbers Association and the Electrical Manufacturers' Association, this School plans to secure data from all sources regarding the sale of electrical merchandise and to tabulate same. The results secured not only will serve to train their students in this industry, but also should assist present men in the industry, as they are to issue pamphlets free to all concerns contributing in any way to the investigation, and at nominal cost to any other interests desiring them.

Your Bureau believes that mention may be made with profit to our membership of the following suggestions that appears as the consensus of opinion of the members of the N.E.L.A. Merchandise Bureau. These suggestions relate to the problem of unloading surplus stocks of appliances which possibly remain on the shelves of our Member Companies due to the "strike" of the buying public:—

"1. Generally speaking, cutting of prices on standard lists should not be the first remedy.

"2. The resistance of the public to purchasing at present prices may be overcome by a more intelligent and intensive sales effort. The public should be made to realize that the advance in price of electrical merchandise during the past few years has been small in comparison with many other essentials, and marked reductions cannot be anticipated. If sales effort does not suffice, then an analysis of inventory should be made with a view to equalizing stock in co-operation with other dealers. One Company may be long on irons and short on percolators. Inquiry among other dealers may find some one long on percolators and short on irons who will be pleased to arrange a satisfactory transaction which will equalize the stock. The same is true of other articles in the list, and inter-company exchange sales may be effected which will prove of mutual advantage.

"3. Again, let us assume there is a supply of irons to turn into cash. It is suggested that the appliance manager offer contractors or dealers in his community an opportunity to buy part of his stock (at a small advance on the original cost price) before the price of a standard article is advertised for sale at a reduced price.

"4. The manufacturer wishes consideration and he is ready to co-operate. The factory representative will gladly help in an equalization process, because he knows stock conditions of the trade in his district. Rather than have prices "slashed" the manufacturer, usually, will take over the surplus stock of the central station dealer. Ask him what he will do to help.

"5. Finally, if none of the suggested procedures bring satisfactory results, reduction sales are justified. Greatest benefit will be obtained however, if the actual conditions of the sale are plainly stated to the purchasing public, and a limited period is made at which cut prices may be obtained. Co-operation with other electrical interests is of paramount importance, and action along the lines suggested will not only create a spirit of good-will among us, but will likewise have a stabilizing influence in the electrical merchandising business during this trying period of readjustment."

EDUCATION COMMITTEE.

Considerable work has been carried out by your Committee during the year in its endeavor to widen the interest of the various Member Companies and their employees in the various Educational Courses of the N.E.L.A.

Representatives have been appointed in each of the larger companies from Halifax in the east, to Fort William in the west. These representatives are working hard to stimulate interest in the courses with a view to securing individual and section enrollments.

A considerable amount of success has been attained. In Halifax, seventy-five (75) per cent. of the Sales staff are taking up the Power Sales Course. A Member Company at Shawinigan Falls has formed a section among their salesmen and staff to study the courses, for all of which they have subscribed. This activity will be pushed during the coming year. In Montreal, enquiries are being received for similar purposes.

Favorable interest has been shown by many companies, and, taking all things together, results may be considered as encouraging and the outlook for the future as promising, if the movement receives the backing and active co-operation of the higher officials of our Member Companies.

To the view point of your Committee it is surprising that more central station employees do not avail themselves of the very excellent opportunities which these Courses present of obtaining that knowledge, both practical and technical, which is so essential to their own advancement in the industry they have chosen for their livelihood.

Your Committee strongly bespeaks the assistance of the higher executives of our Member Companies in the efforts of this, and succeeding Committee, to interest the men of our industry in the Educational Courses, being strongly convinced that very marked benefit will accrue to our Member Companies through the service of a more highly trained staff, and that a higher spirit of loyalty will then prevail.

QUESTIONNAIRE.

To secure information from different sources concerning subjects of timely interest to our membership, your Section drafted the Questionnaire below, to which the following replies were received:—

1. FOR YOUR POWER BILLING DO YOU PREFER A FLAT RATE PER HORSE-POWER PER YEAR OR A MIXED SERVICE CHARGE PLUS METER RATE?

Answers:—

The consensus of replies is in favor of a mixed service charge plus meter rate, four (4) Member Companies expressing preference for this form of rate. Three (3) Companies state they use both systems of rate, two (2) of these stating that their smaller power business is carried on a flat rate wherever practicable. One (1) Company favors flat rates for all power customers, while another prefers the straight block meter rate.

2. DO YOU OFFER ENCOURAGEMENT IN THE FORM OF SPECIAL RATES, CLASS DISCOUNTS, OR OTHERWISE, TO PROSPECTIVE USERS OF SURPLUS OR OFF PEAK POWER? (BY SURPLUS OR OFF PEAK POWER IS MEANT ONLY THAT POWER NOW AVAILABLE, OR THAT IS ESTIMATED, WILL BE AVAILABLE AFTER ALL OF THE REQUIREMENTS OF YOUR REGULAR, STANDARD RATE CUSTOMERS ARE FULFILLED).

Answers:—

Of eight replies, the answers are evenly divided, four (4) each stating that they offered encouragement or did not do so.

3. IF SO, WILL YOU PLEASE ADVISE WHAT NOTICE MUST BE GIVEN BY YOU TO SUCH USERS IN THE EVENT YOU FIND IT NECESSARY, TEMPORALILY, TO DISCONTINUE THIS CLASS OF SERVICE TO ANY CUSTOMER?

Answers:—

Of the four (4) Member Companies encouraging this class of business, two (2) have contract clauses whereby the customer must regulate his load in conformity with the written, verbal or telephone directions of the Company; one (1) Member Company has a clause freeing the Company from liability for damages in consequence of failure to supply service at any time or times, and one (1) Company evidently has no recourse other than to cancel its contract at its expiry.

4. DO YOU EMPLOY PENALTY CLAUSES IN YOUR LARGER POWER CONTRACTS TO REIMBOURSE FOR LOW POWER FACTOR OPERATION AS WELL AS FOR UNBALANCED LOADS ON MULTI PHASE CIRCUITS?

Answers:—

Seven Member Companies state they have clauses to correct for low power factor while one Company as yet pays no attention to this subject. With reference to correcting against serious conditions of current unbalance, no specific clauses are used by any of the Companies that answered the question.

5. IF SO, WILL YOU KINDLY FORWARD COPIES OF SUCH CLAUSES?

Answers:—

Two (2) Member Companies use the following clause:—

"All electrical apparatus made use of by the Consumer shall be of good commercial efficiency and such as to introduce no disturbing elements into the electrical system of the Company. The minimum power factor of the motors when operating Consumer's maximum load shall be as follows: Motors not exceeding five (5) horse-power rated capacity, a power factor of not less than 75%; motors of over five (5) horse-power and not exceeding ten (10) horse-power rated capacity, a power factor of not less than 80%; motors over ten (10) horse-power rated capacity, a power factor of not less than 85%.

If the power factor be found to be less than the above specified, then the power consumption shall be calculated on the basis of the minimum power factor so specified.''

One Member Company uses practically the same clause, stating that the customer must maintain 80% power factor up to 10 horse-power rated capacity of motors and 85% power factor on motors over ten (10) horse-power rated capacity.

Another clause reads:—

''If at any time when power is being delivered to the customer at normal voltage and frequency, the total volt amperes so delivered exceeds that which would result if the power which the customer is then taking were delivered at a power factor of 85%, the volt-amperes delivered shall be calculated as power upon the basis of 85% power factor.''

One (1) Member Company states:—

''The minimum average power factor determined monthly shall not be less than 85%.''

Another states:—

''If the power factor at maximum K.V.A. be less than 85%, then the total amounts of the accounts due for service under this contract shall be increased by dividing such amounts by the power factor as found and multiplied by 85%.''

One Member Company uses this clause:—

''It is agreed that the rates for service herein provided for are conditioned upon the Customer's apparatus taking power at no lower factor than 70%, and should his requirements be such as to cause the power factor in his supply circuit to fall below 70%, then the rates for service herein provided for may, at the Company's option, be increased by the amount of five (5) per cent. for each per cent. the power factor of such service falls below 70%.''

6. DO YOU REQUIRE POWER CUSTOMERS ON REGULAR CONTRACTS TO FINANCE IN WHOLE OR IN PART, THE EXPENSE OF THEIR SERVICE CONNECTIONS?

Answers:—

Four (4) Member Companies require their customers to finance the entire expense of service connection. Two (2) Companies state customer must finance this if revenue from proposed service is believed to be insufficient to meet the expense of connection while the two (2) remaining Companies that answered the question state they install all service connections at their own expense.

7. IF SO, WILL YOU PLEASE GIVE DETAILS, STATING WHETHER OR NOT SUCH PAYMENT IS REBATED TO THE CUSTOMER DURING THE CONTRACT PERIOD?

Answers:—

One (1) Company rebates payment in some cases at the rate of 25% at the end of each year.

Another Company rebates the advanced payment for line construction in some cases in definite monthly proportion of revenue received during the period of the contract only.

One Member Company writes:—

''We require power customers whose revenue is less than 50% per annum of the cost of connection, to pay any expense over and above twice the annual guaranteed revenue. Expense includes meters, transformers and all secondary distribution work but no proportion is estimated for primary circuits unless

they have to be extended or changed, in the latter case, the whole cost of the extension or change will be considered as part of the expense of the customer's service. We do not rebate the cost of such extension except in cases where we are not satisfied that the business is a good commercial risk, under which conditions we have asked customers to pay the whole cost of connection, and rebate the excess over the two to one basis noted above through the medium of monthly discounts on power used. We might say that the above applies also to lighting customers, especially rural extensions where we require the customer to advance the whole cost of connection turning over the property to us for maintenance."

One (1) Company states they make no rebate at all for their customers' payments for service connection.

Another Member Company will extend upon a customer's service connection an amount estimated to equal the gross revenue from two (2) years business.

One (1) Company refunds the payment advanced them for cost of service connection out of power earnings, if service has been used for a certain number of years.

8. WHAT SECURITY IF ANY, DO YOU REQUIRE FROM SHORT SEASON CUSTOMERS (SUMMER COTTAGERS, ETC.) TO GUARD AGAINST LOSS FROM UNPAID ACCOUNTS AT THE END OF THE SEASON?

Answers:—

Three (3) Member Companies require heavy minimum charges and a deposit from unknown customers.

Two (2) Companies ask customer to pay connection and disconnection costs also a deposit which is refunded at the season's end.

Two (2) companies require a deposit of $5.00, while (1) company requires a deposit of $3.00.

CONCLUSION.

Your Section in presenting this Report believes a comparatively brief report is desired by the membership as a whole, and that discussion upon the matters touched upon herein will be of assistance to clear up points which are sometimes susceptible of different views by various members.

Respectfully submitted this 15th day of June, 1921.

GEORGE R. ATCHISON.
CHAS. T. BARNES.
P. R. LABELLE.
J. H. O'HARA.
M. C. GILMAN, *Chairman.*

MR. GILMAN:—I move the adoption of this report.

Seconded by Mr. Anderson.

THE PRESIDENT:—It is moved and seconded that this report be adopted. The interest of the report is obvious to us all. As to the opportunity for discussion, I am sorry to say that it is necessarily limited. If any of you wish to discuss any point, will you be as brief as you can, so that we may complete our programme?

MR. J. B. WOODYATT:—It would not be out of order that we postpone further discussion on this paper, and hear Mr. Robertson's paper. In the meantime we will all have an opportunity to read this paper again and be better able to discuss it after one of our other meetings.

THE PRESIDENT:—A very excellent suggestion. Therefore, if no member has any objection, we will postpone discussion of this interesting paper.

I now have the pleasure to call for a paper of great interest, on "The Consulting Engineer and the Power Company", by Mr. J. M. Robertson.

THE CONSULTING ENGINEER AND THE POWER COMPANY.

By J. M. ROBERTSON.

Mr. Chairman and Gentlemen:—

The time is not far past when for an Engineer in independent practice to admit that he had any particular relations with a Power Company was almost equivalent to admitting that his motives and actions were properly subject to grave suspicion since it was taken for granted that no one could come in contact with such gentlemanly highwaymen—operating under the guise of public utility companies—without becoming more or less contaminated. Those were the days when the most popular even if not the most refined expression of the policy of the Power Companies was "The public be damned."

Fortunately the devil is never quite as black as he is painted—but even the most favorably disposed observer had to admit that the Companies even if they were not black all over were certainly not white. Some of us even in those days had hopes that there was enough vitality about the white part to ensure its eventually displacing at least a large part of the black. I am glad to be able to add the small weight of my testimony to the fact that most of the criticisms which were formerly levelled at the Power Companies for very questionable dealings would now be quite out of place.

I flatter myself that I was among the early exponents of the theory that there was nothing inconsistent in a Power Company being on terms of confidence with its customers—and more than that its real success could be largely gauged by the good feeling that existed between the customer and the Company.

In those days it was the usual custom for the Power Company to deal directly with its customers—or in the case of an important contract with the legal representative of the customer—and the feeling of the customer regarding his chances of getting an equitable deal from the Company was more or less on a par with the feeling of the wayfarer when confronted by the highwayman with a pistol. In the eyes of the consumer the deal was most obviously one sided.

The Company was presumed to know its business thoroughly—and all the weak and strong points in the situation—and the customer was presumed to know little or nothing of so obscure a business as electrical power—and it was, of course, taken for granted that the Company would take full advantage of the situation and come out of the deal with all its demands agreed to—and the customer would, of course, take what was handed him and try to look thankful. At this time Consulting Engineering—more particularly in the electrical line—had not developed to the point where it had become the custom for intending consumers to call in assistance in conducting negotiations and completing contracts, and, consequently, each consumer was compelled to do the best he could without the assistance of specialized information regarding the prevailing rates and conditions in the community in question for

service such as he might require. As a rule the consumer had not even the knowledge of his own probable requirements—which would permit him to analyse his problem and present his demand to the Company in such a way as to secure the most favorable rates available.

The increasing utilization of electric power and the development of specialization both in the industrial and professional departments of recent years has made it imperative—if the best results are to be obtained—that such special problems should be handled by those who have made a study of the situation—both from the point of view of the Power Company and of the consumer. Such a specialist is in a position to advise the consumer as to the most satisfactory methods of utilizing electric power and is able to suggest the most desirable scheme of operations in order to secure the most favorable rates. He can usually indicate pretty closely what the power cost will be under any given scheme and having with the co-operation of his client worked the problem down to the basis which appears most desirable in view of all the conditions he is in a position to approach the Power Company with all the data necessary to convince them that his conclusions are sound and that the rates for the service required should be substantially as anticipated by him.

In territories where the Power Companies are operating without standardized rates—or with rates standardized for the smaller users only the responsibiilty devolving upon the Engineer becomes much greater as his handling of the situation may make a very considerable increase or decrease in the costs of power for his client.

Power Companies—notwithstanding the still persistent impression that they operate on the principle of "all the traffic will bear"—are more or less consistent and to a certain extent influenced by precedent—and if the Engineer is sufficiently experienced he can quote chapter and verse in support of his contention. The old idea that the Power Company having at its disposal all the available knowledge of the subject started the negotiations with a lead—which the customer could never hope to overtake, has been pretty well dissipated. Such negotiations under present conditions when conducted by competent parties are practically certain to result in contracts which are reasonable and fair to both parties.

I think that it is a fact that any Power Company would much prefer to carry on such negotiations with a competent independent Engineer familiar with the conditions of demand and supply and able to judge of the effect of suggested variations in the rates and conditions rather than with the principal himself.

The atmosphere of veiled hostility on the part of the consumer—which unfortunately persists to this day—more particularly on the part of the older generation who recall the good old days when they took what was handed to them and tried to be pleased that it was no worse—is entirely absent. In place of it is an atmosphere of straight business between two equals—each fully informed as to the peculiarities of the others position—and both able to weigh and judge of the weakness and strength of the points raised. There is no question of taking advantage of a man uninformed in the niceties of the business and "putting something over" in such way that the "come back" is certain and sure as soon as the bills begin to come in—with the result that another victim advertises the fact that fair dealing and Power Companies are entirely incompatible.

It goes without saying that in doing work of this kind the Engineer if he is to be in the best position to further his clients cause must have the confidence of the client to such an extent that a bargain having been made with the Power Company the client will stand behind the agreement without variation.

Nothing is more subversive of satisfactory dealing than the feeling on the part of the Power Company that an understanding with the Engineer is not necessarily an understanding with the customer—and that such an understanding having been reached the matter is still unsettled. Everybody appreciated the great difference between an offer for firm acceptance and an offer for negotiating purposes—and if the Engineer is unable to definitely accept he is not likely to get the best bargain.

There are, of course, many districts where the making of a contract does not involve any discussion of rates at all—as all rates are standardized and each class of service takes its proper discount. Under these conditions the task of the Engineer is much simplified. His work is entirely confined to advising his client as to the method of use so as to place the service in the most favorable class and secure adequate service for the lowest possible cost.

Even in such cases the intervention of the Engineer is of considerable advantage to the Power Company, as few things are less satisfactory than trying to explain the why and wherefore of certain rates and conditions and their bearing on each other to a person who knows nothing whatever of the business and cannot possibly understand the inter-relation of the various factors involved. It is proverbial that it takes two to make a bargain—and no bargain is a good bargain unless it is good for both parties. If this is true for merchandise transactions when the parties usually separate as soon as the deal is completed—how much more must it be true in the case of a power contract when the association of the parties only commences upon the completion of the agreement and continues for many years with a potential dispute in every monthly bill. Certainly a power contract which leaves a sore customer is a very questionable asset to the Power Company—even though the return is entirely satisfactory.

On the other hand—there are people in the world who cannot feel that they have secured a fair deal unless they have left the field with all the honors in sight—or as they usually express it—"Have put it all over the Power Company". Such a one though hard to satisfy on any reasonable basis is much more likely to accept the assurance of his Engineer in whom he has confidence that the rate he is getting is right and fair—than the statement of the Company that the rate is exactly what he is entitled to.

The execution of a contract does not end the interest of the man who specializes in work of this kind. He is just as much interested in watching the working out of the arrangement as in making it. In many cases business conditions change very materially after a contract is signed and the contract rates and conditions are found to be quite unsuited to the new business conditions with the result that the power bills run much above what they should.

If such new conditions are likely to be permanent it is the business of the Engineer to take the matter up with the Company with a view to either cancelling the contract and substituting for it some more equitable arrangement—or modifying its terms so that the result more nearly represents the standard return for the service supplied. Of course, the Company in such a

case is not legally obliged to make any concession—but if the Engineer has their confidence and is experienced in his profession he is usually able to convince them that it would be good business to meet the customer fairly and adjust such differences on their merits and not on technicalities.

Speaking as an individual having rather frequent and close relations with most of the prominent Power Companies in the Eastern part of Canada, I am pleased to be able to say that I have found the Companies at all times ready to take a fair and reasonable view of such requests and in some instances I have been agreeably surprised by the granting of concessions which to be perfectly frank I had little hope of myself.

In acting as intermediary in negotiations of this kind the Engineer should feel that he is not exactly a special pleader for his client. His position is much broader than that. He should feel that it is his business to harmonize the conflicting elements in the situation—and by reason of the fact that he is in the confidence of both parties work out a basis that will be mutually satisfactory. The Power Company should feel that he is a friend who will not improperly use his position or knowledge to the advantage of his client at their expense, though, of course, he is expected to protect the interests of his client to the extent of seeing that he gets fair reasonable treatment.

A reputation for fair and straight dealing is one of the most valuable assets that an Engineer can have—and one which in that business pays bigger dividends than any other I can name off hand. Clients do not engage Engineers because their looks are attractive—but because they can secure results —and obviously an Engineer on confidential terms with both parties can get things done that are quite impossible on a strictly legal and formal basis.

Fortunately all the factors which make for a more satisfactory understanding between the Companies and the consumers are working in the same direction. The Companies are becoming more reasonable and less arbitrary—The consumers are becoming more familiar with fair treatment and have less fear of the Company—The Engineers are becoming more experienced and perhaps more diplomatic—and their clients are placing more confidence in them—and the result is that, while the business is growing rapidly, the good feeling is growing even more rapidly—and I am sure that with such a body of interested people all pulling in the same direction, the future of the Power Business must be beyond question.

THE PRESIDENT :—I am sure we have all listened with extreme interest to the excellent address we have just heard from Mr. Robertson. I feel quite convinced that assuming the approaches to the consumer and to the power company to run upon the lines of moderation, reasonableness and fairness indicated in the address we have just listened to, there is likely to ensue such a happy state of relations as has been indicated by Mr. Robertson in his remarks. I shall be glad if some gentlemen will move that a vote of thanks be tendered Mr. Robertson for his address this afternoon.

Moved by Mr. Dion, seconded by Mr. Reid. (Applause).

THE PRESIDENT:—I extend my individual thanks.

WEDNESDAY EVENING—KENT HOUSE.

On Wednesday evening, the 15th of June, a most enjoyable dinner was held at Kent House. There was a large attendance of both ladies and gentlemen. President Grier acted as Chairman and the following speeches were amongst the features of the evening:

MR. W. L. GOODWIN, Society for Electrical Development, Inc., N. Y.

Mr. Chairman, ladies and gentlemen, I feel deeply the privilege and honour of being with you tonight, and have enjoyed a most wonderful day. This is my first trip to Quebec, but I can assure you it will not be the last as I have made plans today to bring Mrs. Goodwin to Quebec with me in August, to see the wonderful sights that I have seen.

The spirit exemplified by this meeting tonight is most fortunate and certain to be productive of good for our commercial health and development. I think we should have more meetings of this kind. It has been my privilege to go from one end of Canada to the other and participate in a small way in the development of this wonderful industry of ours, and aid in the formation of these various associations. When we arrived in Quebec this morning, it was most interesting to hear of the wonderful progress that has been made during the past year in your Quebec Co-operative Association. I think we are just commencing to find on this Continent, the real answer to the commercial problems that relate to our electrical industry. We are a very peculiar people commercially. Technically we speak a language of our own ,and we have struggled with our problems for a number of years, always with that technical mystery and yet a lack of understanding as to why the public did not respond; while if we would just take an inventory of ourselves, and we would just conduct ourselves in our business as we have conducted ourselves today, I think the public would very shortly comprehend not only what we were talking about, but just what we have to do.

I was most interested in hearing a talk at Chicago last week in the National Electric Light Asociation Convention, when one of the speakers, in his talk, referred to the public we have all worried about ,and stated that he could not understand why the public did not comprehend this electrical industry. He summarized the public as divided into several classifications—the classification of the industry, the classification of the tax payer, the classification of the employee, and the classification of the representative of government, and so on, and I wondered if we would look upon the public in its various lights and treat them as they really are. This speaker said that after all we are the public, and that brings to me this thought: at the meeting this afternoon I saw a little card attached to the display of the Ferranti Meter and Transformer Company's fine product: "The last word in meters." I went up to the gentleman in charge of the exhibit and said: "I do not quite agree with you that this is the last word in meters; may I have the privilege of making a point?" He said I might. My point as expressed was, "I think when we reach the last word in meters we will have developed a meter that expresses the value of eletrical energy in dollars and cents, just as we read 2.60 on the taxi-meter of an automobile, and then we will have reached the last word in meters."

The point is this. We understand the dials of a meter. We can read this meter and translate it into K.W., and then by another translation we can translate it in dollars and cents, but the meter is our mouthpiece in our talk with the public, and it is a very delicate little instrument indeed. We of the business understand very well that when it goes wrong it always goes against us, but the public is sure it is always against them. The thought is this: We are dealing in a highly technical commodity, and after all we are selling the most intangible thing possible—service.

The great difficulty with our street railway industry, why it has suffered more difficulties and set backs than perhaps any other branch of this great industry, is due to the fact that we are not able, or have not yet expressed in definite, tangible terms the relative value of street car service so that the public can understand. When we think of the contrast of the horse car of 30 or 40 years ago and the present street car service, and what we give for 5 cents these days, and then realize what the public demands for 5 cents, there is no relative value in the character of the service renderd 30 years ago and the service of today. But we have never been able to establish a measure, or a yard stick, or an instrument, or the last word in the measure of value between the original car service and the car service of today. Now if we are not able to do that, if we are not able to express the value of our service in terms that the people can understand then we must blame ourselves for the lack of understanding on the part of the public. We must learn, and learn quickly, some language which is expressible of a more definite value than the dials of a meter or the intangible car rate value of today.

In that same thought, while we have developed a highly technical industry, we have developed along what I call group levels. We have developed our industry into groups of manufacturers, central stations, contractors, jobbers, dealers and engineers, and we go off by ourselves and have our conventions, each group into itself. We have developed this highly technical organization into a highly competitive group of electrical people. It is only within the last few years that we have commenced to realize that misunderstandings within our own industry reflect misunderstandings to the public. And the more misunderstandings within our own family, the more inclined are we to be misunderstood by the public. We can never hope to have the whole-hearted goodwill and support of the public until we first have the whole-hearted goodwill and support of the members of our own industry within our own organized work, and so this idea of developing these organizations, such as the Co-operative Association of Quebec, and similar organizations which are springing up all over the country, are, to my mind, going to do two things; first, they are going to bring the electrical men to an understanding of their common problem, and to the working out of their local problems; second, from such a clear understanding of our inter-related internal problems in the industry, we will, collectively and individually, create a language which will enable us all to go to the public and speak in an understandable way, which will produce confidence on the part of the public in this highly technical service which we have to sell.

In other words, the problem is our own problem. We are to blame ourselves, and we must first find the answer to our own problem, by getting together in meetings of this kind and discussing our problems.

The great need of the industry for years to come will be its capital requirements. If a sufficient amount of money is fourthcoming, our success is assured, because we have solved practically all of our engineering problems. At least we have solved them to the extent that we can produce a commercial product within reach of men in most moderate circumstances. The great need is going to be for financing. I think every man in the electrical industry should realize the seriousness of the situation. Our securities should be put out in such form that they will merit confidence on the part of the public, so that the reaction that might take place in times of depression will produce the

least possible fear. Our industry offers the greatest possible investment if we put out the right kind of securities, and our industry is properly understood by the public, and it is our object to see that they do. It seems to me our future is assured, but every man must submerge his individual selfish needs to the common interest. We should bear in mind that our individual interests are many and varied; first, we are the servants of the public, and the public interest must come first, and next must come the interests of the industry as a whole, and then must come the group interests—the interests of the manufacturer, the central station, jobber, contractor-dealer or engineer through our group associations. And after that comes the company interest, and last comes the individual interest; and if we will all work with that thought in mind, that after all the individual interest must be submerged to the greater company interest, the company to the group, the group to the industry as a whole, and all to the public,—I do not think we need to fear.

The situation that you see in your sister city of Toronto is not at all enviable, and there is no telling where it is liable to go. Here we have the highest development in the privately owned division of the central station industry in Canada: right in your sister Province is the opposite form of development. Here are two great agencies in competition, competent to prove which of the agencies is most effective and beneficial to the public. I think over a long pull that I would want to wager my money on Quebec. (Applause).

But after all the case is in your hands. It depends entirely on how you conduct yourselves, whether or not over the long pull you prove your case. Everything is in your favour. The greatest danger, aside from the danger of lack of money to our industry, is the danger of removing individual initiative. Our industry is a brand new industry. It is one that calls forth the greatest individual, engineering and financial agencies in order to develop it, and we who have been in the privately owned end of the business know that it offers the greatest opportunity for initiative. This is sufficient reward to keep this industry in privately owned hands for at least a generation or two to come, until we have an opportunity to show the limits to which we can develop this industry, and thus organize meetings such as we have had today. Today at St. Anne de Beaupre was the first time in my experience I have ever seen a group of electrical men all kneel at a shrine. If you can get all electrical men to kneel at the shrine of one denomination, certainly we can get together and solve these very simple problems of the electrical industry, and so can speed with you on with this work, and strive to set up that kind of an organization that offers and invites the fullest co-operation on the part of the men in the electrical business, because after all he is the public.

I may add I am very happy to be here tonight and to see this wonderful spirit revealed. If at any time or at any place I can be of service to the Canadian Electrical Association, you need only to call and if at all possible I will in the future as in the past seek to do my best by, I hope, giving—Service. (Applause).

MR. SAMUEL A. CHASE, Westinghouse Electrical and Manufacturing Co N. Y.

Mr. Chairman, ladies and gentlemen.

Before I forget it, I want to thank you for this invitation to be with you tonight (the invitation came through the Canadian Westinghouse Company) because it gives me an opportunity to meet so many very dear old friends, and I prize the opportunity very highly.

Before I forget it also, I want to congratulate the Co-operative Society here for the splendid results they have obtained in such a short time. You have certainly done splendid work, and I am very happy to see the same spirit here that we enjoyed in the U. S., through this same sort of co-operative work.

It is a rather remarkable incident tonight, that this is the first time that I have had the pleasure of being at a meeting with Mr. Goodwin since he has become associated with the Society for Electrical Development. Having worked with him three or four years in practically the same line of work, it certainly gives me great pleasure that here at Quebec I am with Mr. Goodwin on his new work for the first time. Right here let me add that we are in thorough sympathy with that work, and we feel that there is a wonderful opportunity for it. We need such an organization as that, and I hope you will all co-operate with Bill in the good work that you all know he is going to do. Personally I am going to give to Bill the very best that is in me in this new work.

We frequently hear a remark, more or less from a selfish standpoint: "What is the General Electric Company getting out of this association and co-operative work? What is the Westinghouse Company getting out of this association and co-operative work?" I might ask a question: "What does anyone get out of association work or co-operative work?" The other day I prepared a little answer which I think is possibly a good answer: "Living is giving; all life is an interchange. You get back only what you have given. Business, in the last analysis, is service, and service is only another name for giving."

Owing to the lateness of the evening I am going to put off, until tomorrow night, telling you about the Goodwin plan, about our efforts in the last three or four years in harmonizing the industry, and incidentally to tell you about some of the results of that work in various cities; and I am happy to say that throughout the United States harmony and prosperity exist in the entire industry, excepting in a few, very few spots, where they won't learn that lesson, and follow that slogan that I told you about at Montreal and Toronto of "Live and Help Live". I am going to tell you some more about that tomorrow night.

As I look over this gathering and hear the music, I cannot but recall a remark I made, I think at Montreal or Toronto, when I said that that gathering, and I will say again, that this gathering also reminds me of an orchestra—a grand electrical orchestra. Now there is one thought in connection with that, and that is, in that orchestra we must provide a place for the smallest instrument. We must see that the smallest contractor—dealer has an opportunity in this orchestra to play his favorite instrument. I feel also, and I know you do in listening to this beautiful music, and as you will listen to the orchestra in the ball room, that it is necessary, in order to produce good music, to play in perfect harmony. In order to play in perfect harmony the music must be written, the musicians trained, and the instruments tuned before we can play in perfect harmony. But there is no doubt, ladies and gentlemen, from what we have observed tonight, and during this beautiful afternoon (one of the most wonderful I have ever spent) that here in the Province of Quebec, through the close co-operative work of your various electrical organizations, you are going to play that tune here in perfect harmony.
(Applause).

Mr. W. H. Onken, Jr., Editor, Electrical World, N.Y.

Mr. Chairman, ladies and gentlemen.—As public utility operators, I need hardly remind you that the times through which we are passing are rather trying, but I would not have you carry away any impression other than that the future is most promising. We are not as badly off as we say nor as well off as we think. Our industry is made up of men of ability and experience, capable of meeting almost any emergency with the means at our command, or a proper evolution of them, provided our plans are not thwarted and our energy paralyzed by the ill-considered and ill-founded interference of the demagogue, and by the wild visions of well meaning but irresponsible dreamers.

The present is a time of great opportunity as well as of great responsibiilty. Change is inevitable, progress is eternal, and we must draw from the present the same lofty inspiration which animated the pioneers of the past, and be equally earnest and diligent in achievement.

The crucial factor is still the acquisition of new capital. This has handicapped us in the past and the handicap is not likely to disappear entirely until some time in the future. When the proud metropolis of the Western Hemisphere fails to attract sufficient capital for six percent tax-exempt securities, it is time to reflect on the scarcity of capital and on our chances of getting a fair share of what there is of it.

Having passed through the furnace of affliction during the past five years, the electric light and power companies have finally emerged, somewhat singed to be sure but nevertheless refined. The ultilities were not war profiteers but on the contrary were numbered among the war's wounded. We fought the menace of civilization as truly as though we had enlisted, and we were not only used but abused. The record of electric light and power companies during and after the war is such as to instill a sense of pride and satisfaction. I know not what others may think or how they may feel about this matter, but for myself I look upon our present plight as a badge of honour.

The period was one of great test and trial, and on the whole the electric utilities have stood it remarkably well. We have continued our service unabated, and in the main at pre-war rates, notwithstanding the handicaps of high labour, material and other costs. Of necessity we have been compelled to become more and more efficient, with the result that we have to our credit fewer failures than any other industrial or public service group.

The demand for service goes on continuously even in times of great business depression. This requires additional generating capacity, lines, transformers, meters, etc., and so far as it has been humanly possible the electric light and power companies have provided in times of stress as well as in times of general prosperity the necessary physical equipment. But we cannot do the impossible. A magician may remove from a borrowed hat a larger aggregate of stuff than the hat could possibly have contained, but while he may strain credulity he deceives only the eye of the observer. People seem to have implicit faith in the miraculous power of electricity, and imagine also that the resources of the corporations are limitless. We who are on the inside know how meagre the available funds are at present and how much more pressing are the financial than the operating and commercial problems.

This leads me to the question of service, which has already been so admirably touched on by Mr. Goodwin and Mr. Chase.

Service, my friends, is the crucible in which our integrity as public utility operators is assayed. It is the very essence of duty and accomplishment. No matter what we may do to win favour and support, no matter what we may say about justice to the utility and the right of a fair return on money invested in public use, the electric light and power companies of the country now and always will be judged by the quality of service they render. Mutual effort, self-interest and that sort of thing are beautiful sentiments for occasional oratory, but sentiment ends and duty begins at the meter. No lasting or sound public relationships can be established or maintained without first class service as a foundation.

In ordinary merchandising good service is compelled by competition, and time was when citizens were prone to invoke competition in public service in the hope of effecting cures, only to find that the remedy was worse than the disease. Every thinking man now recognizes the inherently monopolistic character of the business in which we are engaged, and while certain standards of performance may be required as a matter of right, as a matter of expediency no utility should invite censure of any kind, or have its proficiency questioned. Our fitness is determined alone by the higher law of service, and our duty is manifestly to provide the best service possible.

Knowing and being keenly alive to our own interests, we should endeavor by the very excellence of our service to remove ourselves far beyond the necessity of restraint and control and the tyranny of it. Initiative, which has always characterized our industry, is still its quickening force, but it can be checked and even suffocated by authority in proportion to the rigidity to the restrictions imposed. Control may be easily overdone, and the consequence of excessive restriction is stagnation. We should therefore so comport ourselves and conduct our business on so lofty and righteous a plane that regulation will be a holy weapon and that government will not find it necessary to thunder its edicts against us. In all humility we must recognize the facts that we are not sovereign but servant, not over but under the people. Nor is government the author of the public weal. It is the guardian of it, and it is most economical and effective when it sees its bare duty and does that and no more.

Let us therefore look to our service and bring it as near perfection as possible. Let us show the people that we are doing our utmost to give them an and in a spirit of co-operation and fellowship, but let us not stop there. Christianity would have died with the apostles if they had not gone out and adequate, unwasteful, uninterrupted supply of electricity at the least cost, applied it. Our mission is not only to produce, but to sell and apply electricity. As an industry we have been content to manufacture something of immense value to mankind, and then have neglected the most important thing of all, to get mankind to use it. What a glorious opportunity awaits those who can see ahead. A general advance in human conveniences and comforts, in industy, in production, in trade and in commerce should be our goal and we must not be afraid of working hard for it. We certainly have reason for higher courage, cheerier spirits, braver outlooks, and renewed efforts, for inspired by the brilliant conceptions of our leaders and pioneers, and stimulated by the ennobling and sanctified purpose of dedicating ourselves on the altar of service we cannot fail.

DR. WALTER CARR, Editor, "Electrical News", Toronto.

Mr. Chairman, Ladies and Gentlemen.—I am glad that Mr. Onken has spoken before me, as he represents, plainly, the exception that proves the rule that editors cannot make a speech. However, I thank our President for the suggestion of an idea that I want to pass along to you. Most men in the industry, I believe, think of it as being composed of five sections—manufacturer, jobber, central station, contractor-dealer, consulting engineer. Our President has called on two editors tonight—two publishers of electrical trade magazines—and in that way has indicated to you that he, at least, considers the trade magazine twice as important as any other phase of the industry. I am only going to leave this idea with you, ladies and gentlemen; is it not fair when we think of the electrical industry in future, that we think of it as being composed of six parts, of which the electrical trade press is co-equal with the other five?

THURSDAY MORNING, JUNE 16th, 9.15 A.M.,
"EMPIRE" THEATRE.

THE PRESIDENT:—Now the first paper on today's programme is a paper on "Electrons", with lantern slides, by Mr. W. B. Cartmel, of the Northern Electric Co.

ELECTRONS.

By W. B. CARTMEL, B. Sc., M.A., Fellow of the American Physical Society, Northern Electric Company Limited, Engineering Department, an address presented to the Northern Electric Engineering Society, in the Mechanics Institute, Montreal, January 31st, 1921, and to the Canadian Electrical Association, in the Empire Theatre, Quebec City, June 16th, 1921.

SYNOPSIS.

In this paper an attempt is made to give to a popular audience a physical conception of electrons. In order to be convincing, the experimental side of the subject is stressed and experiments have been chosen that were thought to be the most striking as far as the means at hand would permit. After stating that electrons are minute particles of electricity and that the atoms of matter are built up of them, six methods of producing electrons are shown:—

1. The production of electrons by the methods of frictional electricity.
2. The emission of electrons from hot bodies.
3. The emission of electrons from zinc under the action of ultra-violet light.
4. The emission of electrons from air under the ionizing effetc of X-rays.
5. The emission of electrons from a highly charged cathode in the X-ray tube.
6. The spontaneous emission of electrons from radio-active substances.

Credit is given to Sir J. J. Thomson for the discovery and isolation of the electron, though it was thought beyond the scope of the paper to even mention the labors of Larmor and Lorentz in which they were forced to assume the existence of electrons in order to account for the Zeemann effect and other optical phenomena. C.T.R. Wilson's cloud method for obtaining the charge on an electron is mentioned but Millikan's oil drop experiments are dwelt on in more detail, because in themselves these experiments furnish so convincing a proof of the existence of minute particles of eletricity, all exactly alike.

The counting of flashes on a zinc sulphide screen due to bombardment by alpha-particles and Sir Ernest Rutherford's corresponding electrical method are mentioned since the evidence given by these experiments is so direct. Mention is also made of Rutherford's nuclear atom theory and experiments leading up to it, such as Wilson's photographs of the trails of alpha particles and Geiger and Marsden's experiments on the scattering of alpha particles by thin sheets of metal. Moseley's photographs of X-ray spectra are shown and their bearing on the nuclear atom theory explained, also the illuminating effect Moseley's experiments have on Mendeleeff's table. Bohr's model atom is discussed but it was thought beyond the scops of the paper to touch on Langmuir's modifications of Bohr's theory. Finally Rutherford's recent work on the bombardment of the atoms of gases is mentioned, and J. J. Thomson and Astons work on positive ray analysis.

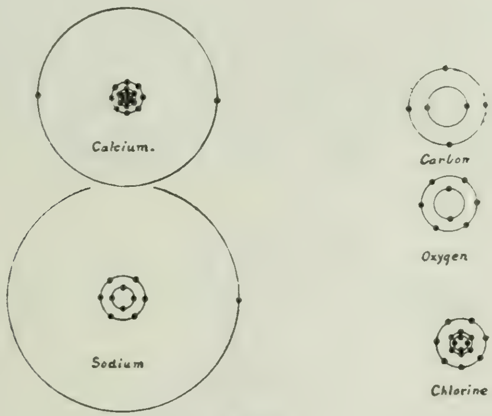
WHAT ELECTRONS ARE.

Electrons are very minute particles of electricity. It has been thought for many years, even as far back as Ancient Greece, that all matter consisted of particles or atoms and now we have positive proof of this and also that electricity is made up of particles having a definite size. We know to-day while ordinary matter, such as for instance, wood, iron and in fact all substances are made up of tiny particles, these particles of matter are again made up of minute particles of electricity, or electrons. I will try and give a concrete idea of the size of the particles or molecules of which all ordinary matter is composed by stating that the smallest particle that can be observed with the highest power microscope that it is possible to construct, is about 1000 times as big in diameter as a molecule of hydrogen or oxygen, and one of these molecules is about 60,000 times as big as an electron. We have a great many very convincing ways of showing that these electrons exist, in fact the great mystery which has existed in the past as to the nature of electricity has in recent years been cleared up by a very large mass of evidence. In this connection it is rather curious that it was found out a great many years ago that electrons could be torn away from the particles of certain substances, although it was not known then that they were dealing with *particles* of electricity. I am referring to the discovery by a Greek named Thales who in the 6th. century B. C. discovered that amber when rubbed, acquired the property of picking up light objects such as pieces of paper, etc. From the Greek word "electron" meaning amber, we derived our word electricity, and now we have come to use the word electron to signify the little particles which we have found make up electricity. What happens in rubbing amber is that the act of rubbing removes some of the molecules both from the amber and from the rubbing substance, and electrons are also torn away.

The electric charge on the amber gives it the property of attracting uncharged bodies. It is now known that very many substances besides amber can have electrons rubbed from off their surfaces; for instance glass rubbed wtih silk, sulphur or hard rubber with cat fur or with wool. It is probable that the rubbing together of almost any two different substances will by the dislodgement of electrons give rise to an electric charge, though in a great many cases it would be difficult to demonstrate this. It is however a matter of common experience that under certain conditions sparks may be obtained from the finger tips by rubbing ones foot on the carpet, or by stroking a cat, and that quite large sparks may be obtained from a leather belt driving machinery.

RELATIONSHIP BETWEEN ATOMS AND ELECTRONS.

In order to obtain a concrete idea of the relationship that exists between atoms and electrons, I will show a diagram representing one writer's idea as to the arrangement of atoms in different substances (Fig. 4). This diagram was taken from a paper by Arthur Compton in the Physical Review for January 1917. The particles shown are electrons, that is to say particles of negative electricity, and they revolve around a central nucleus of positive electricity. This central nucleus is not shown because it is so small, being very much



(Fig. 4)

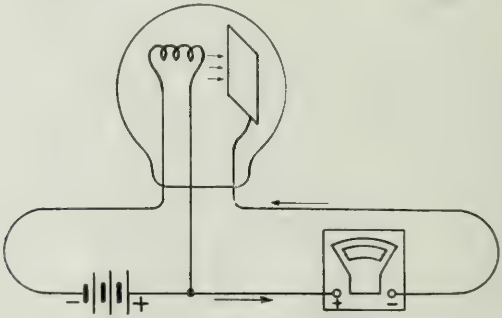
smaller than an electron. It will be noted that the atom of oxygen has two electrons in the inner ring and six in the outer ring, making eight electrons in all, while carbon which has two in the inner ring has four in the outer ring making six in all and the atom of hydrogen, not shown has a single electron revolving around its nucleus. We shall see later that the atoms of different substances differ in having different numbers of electrons, the central nucleus in all cases having a positive charge of electricity equal to the number of electrons surrounding it, which as we have seen are negative, so that the atom is electrically neutral. We have already seen that electrons, may be detached from atoms by rubbing and we shall see that there are a number of other ways in which they may be detached such as for instance by heating.

ELECTRONS PRODUCED BY HEAT.

It has been known for over a hundred years that when a metal was brought into a state of incandescence, the air in its neighborhood became a conductor of electricity, and as we shall see, the fact the air was made a conductor of electricity is evidence of an emission of electrons. This phenomenon was studied during the years 1882-1889 by Elster and Geitel, two German Professors, who found that when a glowing metallic filament was placed near a metal plate, the latter became charged with electireity. In 1883 Edison

noticed a similar effect in experimenting with his carbon filament incandescent lamps. Enclosing a metal plate within the lamp bulb, a current flowed from the filament to the plate, if the plate was connected to the positive end of the filament, while if the plate was connected to the negative end, no current flowed.

The arrangement used is shown in Fig. 5. It will be noted that negative electrons shoot off from the white hot carbon filament and impinging on the plate give it a negative charge, and that current flows from the positive side of the battery through the connecting wire to the plate, thus neutralizing the negative charge. This is one way of stating what happens, though as a matter of fact the flow of current in a wire is in the opposite direction from what we have generally supposed it to be. This is explained in the following way At the time the convention was adopted as to the direction of flow of electric current, it was recognized that there were two kinds of electrification one kind obtained by rubbing glass with silk and the other by rubbing sulphur or resin with cat fur. These were first called vitreous and resinous electricity respectively, but later Benjamin Franklin distinguished between them by calling them positive and negative electricity. This is the so called two fluid



(Fig. 5)

theory of electricity according to which the positive current flows in one direction, with a simultaneous flow of negative electricity in the opposite direction. Franklin however put forward a single fluid theory which asserted that all bodies contain a certain amount of a fluid called electricity; positively charged bodies contain an excess of this fluid and negatively charged bodies a deficiency. Unfortunately there was no way of knowing at that time which of the two, the vitreous or the resinous charge on a body represented an excess and which a deficiency. It was assumed however that the vitreous charge represented an excess of electrification over the normal amount. Later when voltaic cells or batteries became known it was found that the zinc electrode of the battery acquired a charge which was resinous or negative, while the copper electrode acquired a charge similar to that obtained from glass rubbed with silk. It was, therefore, concluded that the current in flowing through the connecting wire, flows from the copper to the zinc. Going back to Fig. 5 we will find the explanation somewhat simpler if we assume that the current flows through the wire in a direction opposite to that shown by the arrow. Beginning with the flight of electrons through vacuous

space from the heated filament to the plate, these electrons settling on the plate give it a negative charge and they therefore tend to flow through the wire to the positive electrode of the battery and so on around and around. This is in accordance with the theory now accepted that in good conductors a few of the electrons are free to move, so that when a conductor is connected to a battery or other source of E.M.F. the electromotive force simply drives the electrons along through the wire. The negative charge on the plate drives the free negative electrons in the wire onto the plate and electrons constituting the charge on the plate into the wire.

I will now show experimentally the emission of electrons by a hot body. I will first charge up this electroscope and when a red hot wire is held near it, you will notice that the electroscope loses its charge. The explanation is that electrons shooting out from the red hot wire, make the air conducting and the charge on the electroscope leaks away. Air made conducting in this manner is said to be ionized, and as a great deal of what we know about electrons has been discovered by means of experiments involving ionization, I will digress at this point to explain more fully what this term means. Ordinarily air does not conduct electricity, but under the action of certain agencies the molecules of air are broken up into negatively and positively

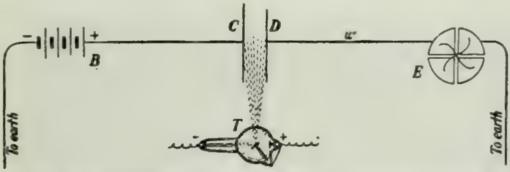


Fig. 577.—An arrangement to exhibit the conduction of electricity by air. The X-rays *ionize* the air.

(Fig. 6)

charged ions or carriers of electricity, the detachment of an electron leaving the molecules with a positive charge.

ELECTRONS PRODUCED BY X-RAYS.

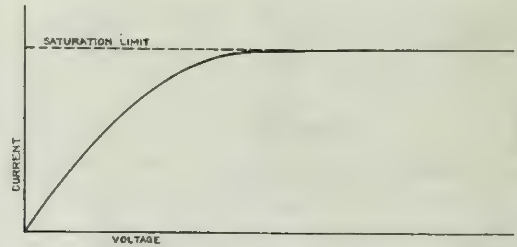
One of the best means of producing ionization is by means of X-rays and fig. 6 shows a circuit drawing of an experiment on ionization. Two flat plates a few inches apart are connected one to a battery and the other to an electrometer. Naturally no current flows under these circumstances but on turning on the X-rays, the air between the plates becomes ionized and a current flow is indicated by the electrometer, the current being carried by ions; the negatively charged ions or electrons being drawn to the positive plate, and the positive ions drawn to the other plate. The flow of current in this case is peculiarly different from the flow through an ordinary resistance, where the current is proportional to the voltage, in other words when we double the voltage we double the current and so on. In this case increasing the voltage increases the current up to a certain point; the current however does not increase proportionally, but increases by a smaller and smaller amount as the voltage increases and finally does not increase any more. The space is then said to be saturated and this current is spoken of as the saturation current because the ions are carrying current to the limit of

their capacity. Fig. 7 shows how the current increases with increase of voltage on the plates. Metallic conduction differs from this sort of conduction in that there are practically an unlimited number of ions to carry the current and only the electrons move, the positive nuclei of the atoms remaining fixed. We know that if the positive nuclei moved also, there would be a transfer of particles of one metal into another when two dissimilar metals forming part of an electrical circuit touch one another. Such an effect however has never been observed.

PRODUCTION OF ELECTRONS BY ULTRA-VIOLET LIGHT.

I will now show a fourth method by which electrons may be obtained, and that is by means of ultra-violet light. If ultra-violet light falls on a zinc plate, electrons are given off. This is known as the photo-electric effect and was discovered by Hertz in 1895, when experimenting with electromagnetic waves, of which he was also the discoverer. He found that he could not obtain a satisfactory spark from the terminals of his induction coil if the negative terminal was illuminated with ultra-violet light, and that this was due to a leakage of negative electricity.

I will again digress to show what ultra-violet light is and why we call this the photo-electric effect, and then will show this result experimentally.



(Fig. 7)

On sending a beam of light through this prism it is spread out into a band of colors. Now light as you all know consists of waves, violet light having the shortest wave-length and red light the longest; light of a shorter wave-length than the violet is known as ultra-violet light. Our eyes are not sensitive to this very short wave-length light which however affects a photographic plate even more than visible light does. If light of this sort falls on a polished zinc plate electrons are emitted. This effect of emission of electrons by ultra-violet light is called the photo-electric effect because it is an effect requiring light of the sort that affects a photographic plate. By means of this sheet of ruby glass you will see that we can cut out light of all colors except red and we also cut out the ultra-violet light, but we cannot see whether it does this or not because of our eyes not being sensitive to this kind of light.

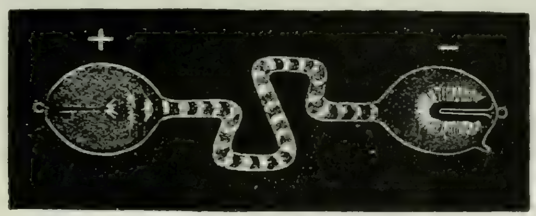
It is easy to show that electrons are emitted from zinc illuminated by ultra-violet light. I will charge up this electroscope with negative electrification, in other words I will give it an excess of electrons. This zinc plate is connected to the electroscope by a fine wire and therefore takes a negative charge at the same time. Allowing ultra-violet light from the spark of an induction coil to fall on the plate, electrons are emitted by the plate, dim-

inishing its charge and causing, as you see, the leaf of the electroscope to collapse. Charging up the electroscope again and interposing a sheet of paper so as to cut off the light from the spark, the electroscope retains its charge until the paper is removed, when it discharges again.

Having given a brief description of electrons, and four methods of obtaining them, I will say something about the history of the subject and about how electrons were discovered and will then take up some other methods of producing electrons.

DISCOVERY OF ELECTRONS.

A century ago when it was found out that substances could be separated into their elements by the passage of an electric current, men like Berzelius and Sir Humphrey Davy held the view that atoms were held in combination by electrical forces, in fact Berzelius built up a theory of electro-chemistry, in many respects similar to what is held to-day. In 1833 Faraday discovered his well known laws and showed that a definite quantity of electricity was associated with each atom. It would seem however from the way in which he stated his laws of electrolysis that he had no idea that electricity consisted of particles, but rather that a definite quantity of a continuous electrical



(Fig. 8)

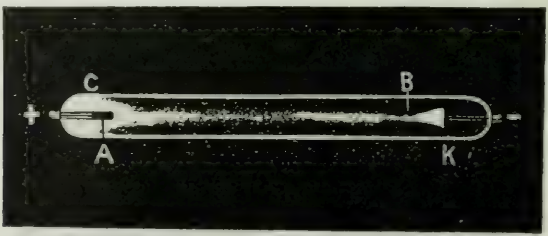
fluid was associated with an atom. It was in this connection that the name electron was first brought forward. Professor Johnston Stoney of Dublin University called attention to the fact that the quantity of electricity associated with the hydrogen atom in electrolysis is a natural unit of electricity and he proposed to call this unit an "electron". Now that we know that electricity consists of particles having a charge equal to the natural unit of electricity to which Stoney gave the name electron, we call the particles electrons.

Our knowledge of electrons as discrete particles however, came about through experiments on the electric discharge through gases. A great deal of investigation work has been done along this line by a large army of workers, particularly by Sir J. J. Thomson and his pupils, and many volumes have been written on this subject. We will however only take up two conditions of gaseous discharge.

We shall first consider the case of a glass tube having electrical terminals or electrodes sealed into the ends, and exhausted by means of an air pump so that only about one ten thousandth of the original air remains. Very beautiful effects are obtained when electricity passes through tubes pumped out to this degree of exhaustion. Tubes of this sort, known as Geissler tubes, are often

made into fantastic shapes as shown in fig. 8. I have here five such tubes connected by wires with the terminals of this induction coil. You will note that the air in these tubes has become conducting to such a degree that the current passes through the five tubes in series, giving an air path of approximately forty inches, rather than jump between the sparking terminals of the induction coil, through half an inch of air at atmospheric pressure.

The other case we shall take up is where the air is pumped out to a very much higher degree of exhaustion. Pumping out more of the air from the tubes causes the electric current to pass through them with more difficulty, because the further removal of air makes a shortage of molecules for ionization. On exhausting a tube to a very high degree, a voltage sufficient to produce a spark of several inches in air is necessary to cause current to pass through the tube. Sixty years ago experiments were made with tubes evacuated to a millionth of an atmosphere which was about as high a degree of exhaustion as it was possible to produce at that time. It was found that in such tubes there was no glow with beautiful colors as in the Geissler tube, but instead

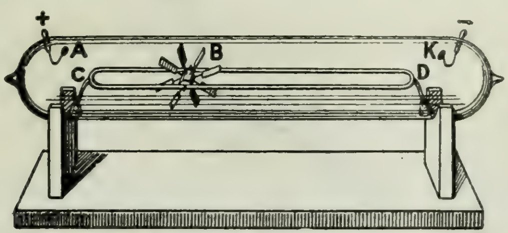


(Fig. 9)

there was a beam of bluish light proceeding normally from the cathode or negative terminal of the tube. This bluish light known as cathode-rays impinging on the walls of the glass tube caused it to glow with a yellowish-green glow. In 1876 Sir Wililam Crookes announced the view that the cathode-rays consisted of particles of matter which he called radiant matter. He assumed that in addition to the three known states of matter, solid, liquid, and gaseous, there was a fourth state, which bore a relation to gaseous matter similar to that which gases bear to liquids. Time has proved this to be a most brilliant guess, for we know now that the cathode-ray particles are electrons, which form an essential constituent of the atoms of matter. There is the similarity that at fairly high temperatures electrons evaporate or boil out of metals, and probably out of all substances at sufficiently high temperatures.

To support his views Crookes constructed a high vacuum tube within which was a wheel with vanes as shown in fig. 10. The cathode-ray particles or electrons impinging on the vanes of the wheel caused it to revolve. It could also be shown that the cathode stream as it was called could be deflected by means of a magnet. That is it behaved in a similar manner to a wire carrying an electric current, which as everybody knows to-day, will tend to be deflected by an electromagnet. This is illustrated by an ordinary electric motor. When

the wires on the armature carry an electric current they are pushed sidewise by the action of the field magnet and cause the armature to rotate. If we change the direction of the current in the wires on the armature, the wires will be pushed sidewise the opposite way, in other words, the motor will rotate in the opposite direction. In a similar manner the cathode stream, which is equivalent to a current of electricity, was found to be pushed sidewise by a magnet. By noting whether the North Pole of the magnet for instance deflected the cathode stream to the right or the left, the direction of the current in the cathode stream was determined and found to be equivalent to a negative current. It has already been mentioned that the cathode stream might affect the glass containing vessel and make it give out a yellowish-green light. This property of exciting luminosity in the glass is known as phosphorescence or fluorescence. It was known that the rays from Crookes tubes could excite fluorescence in other substances than glass, particularly in a chemical known as barium platino-cyanide. Professor Roentgen was interested in making experiments with a Crookes tube and a barium platino-cyanide screen and accidentally noticed that the screen became illuminated with a phosphorescent glow, when the Crookes tube was covered with a black cloth. The Crookes tube was found to send out radiations which could pass through opaque substances. These radiations were given the name "X" rays. I have here a picture of a tube especially designed for X-ray



(Fig. 10)

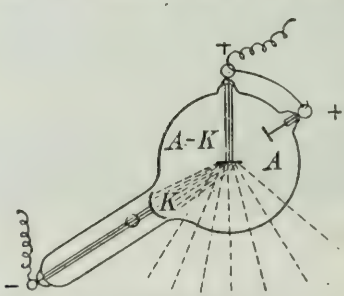
work (fig. 11). In the operation of this tube the cathode particles are shot with an enormous velocity and strike a plate known as the anti-cathode, which is connected to the anode. The bombardment of the anti-cathode with the cathode ray particles causes it to emit X-rays. It is now known that while the cathode rays consist of negatively charged particles or electrons, the X-rays are really a sort of light waves, differing chiefly from ordinary light in being of a shorter wave-length. Just as violet light is of a shorter wave length than red light, so X-rays are of a much shorter wave length than violet light. X-rays have the important property of passing through matter opaque to ordinary light, and as we have seen the very important property of being able to cause ionization.

This ionization may easily be shown as follows: I have here a little electroscope mounted in a projecting lantern. On charging the electroscope you will note the little leaf of aluminum foil stand out at right angles to the supporting wire. At the other end of the table is an X-ray apparatus. On causing this to emit X-rays you will notice that the electroscope loses its charge, as indicated by the gradual fall of the strip of aluminum leaf.

We have seen that electrons are shot out of the atoms of metals heated to a high temperature, that they are shot out of zinc or the alkali metals under the action of certain kinds of light, also that they fly off the negative pole or cathode of a highly exhausted glass tube under the action of high voltage.

SPONTANEOUS EMISSION OF ELECTRONS BY RADIO-ACTIVE SUBSTANCES.

We are now going to see that there are certain substances such as radium, called radio-active substances, that are continually shooting out electrons without any apparent cause. In this case the emission of electrons is accompanied by an emission of X-rays, just as the bombardment of the anti-cathode of an X-ray tube excites X-rays. The discovery of these radio-active substances was brought about in the following manner. Shortly after the discovery of X-rays, it was discovered by a French physicist named Henri Becquerel, that the element uranium gave out radiations similar to X-rays. It was later found that a mineral substance called pitchblende which is the ore from which uranium is obtained, gave out these radiations even more

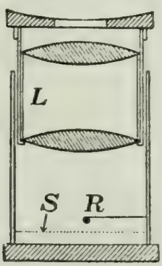


(Fig. 11)

strongly than did uranium itself. This made people suspect that pitchblende contained a substance more strongly radio-active than uranium and Madame Curie, after a great deal of labor succeeded in separating a substance from pitchblende, which she called radium. With radium it was possible to perform experiments quite similar to those that could be performed with X-rays, that is, we could make X-ray pictures with radium, and air could be ionized with it. A study of the behaviour of radium led to a clearer understanding of the nature of X-rays. One of those who did a great deal to give us an understanding of substances like radium, was Professor Rutherford of McGill University, now of Cambridge University. In 1899 he announced that there were two different kinds of rdiations from radium, to which he gave the name of alpha and beta rays and later discovered a third type which he called Gamma Rays. The alpha, beta and gamma rays, which are given off together from the radium may be separated from one another by means of a strong magnet. We have already seen in the case of the cathode stream of electrons, that by deviation with a magnet we could determine from the direction of the deviation that the particles are negatively charged. Similarly the pole of a magnet will deflect the beta particles in one direction, and the alpha particles will be very slightly deviated in the opposite direction, and it is

thus found that the alpha rays are positively charged particles and the beta rays negatively charged particles. The gamma rays are however not deviated at all. Since then it has been found that the alpha particles are positively charged atoms of a gas called helium, the beta rays are electrons, and the gamma rays are X-rays of very short wave length. We now know about six radio-active substances, and these change from one to another by giving off alpha and beta particles. In the process X-rays are generated. The way in which the alpha particle was proved to be a positively charged nucleus of the helium atom is very interesting. These particles are so minute that they will pass with enormous velocity through thin sheets of glass. Taking advantage of this property of the alpha particle, Professor Rutherford caught a number of them in a thin walled glass tube. On regaining their lost electrons they became enormously increased in size and could no longer pass out of the tube. The presence of helium gas was afterwards detected in the tube by means of a spectroscope.

By studying the behaviour of alpha particles a great deal of information has been obtained in regard to the number of electrons in a cubic centimeter of gas, and the charge carried by an electron. It was found that if alpha particles were allowed to strike against a zinc sulphide screen, that with a low power microscope one could see a bright scintillation every time an alpha



(Fig. 12)

particle struck the screen. This piece of apparatus is the so-called spinthariscope of Sir William Crookes (fig 12). With a very small amount of radium, so few particles would strike the screen per second that it would be possible to count the number of particles emitted. Now as we have already seen the alpha particles are positively charged atoms of helium gas. Knowing how many alpha particles are emitted in a given time from a minute quantity of radium of accurately known weight and knowing the volume of helium gas that could be collected in a much longer time from a much larger amount of radium also of accurately known weight, it was possible to determine the number of helium atoms in a cubic centimeter of helium gas. In a somewhat similar experiment, both the charge on an alpha particle and the number of alpha particles was determined. The alpha particles were caught in a vessel connected to an electrometer by means of a wire, and every time one of them was caught the electrometer needle gave a jump. In this way not only could the number of alpha particles emitted in a given time be counted as in the spinthariscope experiment, but the total charge given up by them was

determined at the same time. Dividing this total charge by the number of particles gave the charge on each. This was found equal to twice the charge on an electron, and of the opposite sign.

PROOF OF EXISTENCE OF ELECTRONS.

We are now going to take up some very direct methods of demonstrating the existence of electrons. The property of ionizing air possessed by X-rays has led to innumerable experiments which gave us information in regard to the size of the electrons, the magnitude of the electric charge carried, etc. Early experiments in England consisted of ionizing the air in a closed chamber by means of X-rays, and then suddenly expanding the air so as to produce a cloud of vapor. Now in the production of a cloud of vapor there is required a number of tiny particles for the drops of moisture to form upon. These are known as condensation nuclei. In order to remove dust particles which might serve as condensation nuclei, the air in the chamber was given a careful filtration previous to ionization. The resulting cloud of vapor, therefore, consisted of tiny droplets of water formed around positive and negative ions.

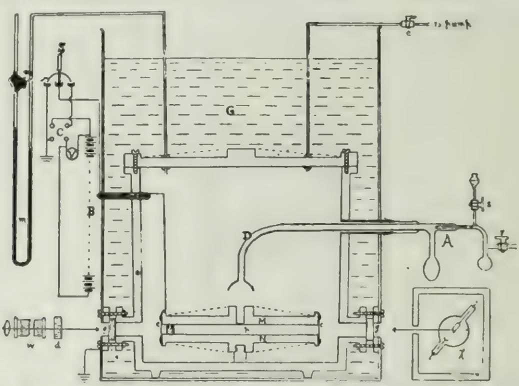


Fig. 8.—[illegible] atomizer through which the oil spray is blown into the [illegible] D. G [illegible] keep the temperature constant. M and N [illegible] plates electr[illegible] [illegible] and illuminates droplets between plates M and N through [illegible] X-rays from the bulb X.

(Fig. 13)

We can find the size of the droplets from the time they require to fall, because they are so small that their time of falling depends on the resistance of the air, and the time of falling gives us a measure of the size of the drops. By calculation from the known expansion used, and the total volume of the vessel, we may find the total mass and volume of the water condensed in the cloud. Dividing the total volume by the volume of each drop, we obtain the number of drops formed. By making measurements of the current through the cloud, it is possible to determine the charge carried by each ion.

DETERMINATION OF THE CHARGE ON AN ELECTRON.

These experiments were extended and modified by Professor Millikan, who finally found it possible to work with single droplets of water, which is preferable to working with a mass of droplets in a cloud in which case only

an average effect could be obtained. He afterwards substituted oil for the water so as to eliminate errors due to evaporation. The apparatus used is shown in fig. 13 in which you will see a closed iron chamber "D" surrounded by an oil bath, which was necessary to keep the apparatus at a constant temperature. An atomizer "A" sent a spray of tiny droplets of oil into the iron chamber, and one of these droplets was allowed to fall through a tiny hole "p" after which a cover was moved over the hole by means of a relay, to prevent any more drops from falling through. The drop was illuminated by means of an arc light "a" and observed by means of a telescope having a high power eyepiece. The two metal plates "M" and "N" separated by hard rubber spacers could be connected to the 10,000 volt battery "B" and an electrical field could thus be established between them.

The drop was allowed to fall under the action of gravity and it was noticed that the speed of falling would increase until it reached a value where the friction of the air prevented any further increase. It would then continue falling constantly at this maximum speed, which, however, was quite slow. The speed could be measured by observing with a stop watch (or better with a chronograph), the time required for the droplet to fall a certain distance which could be measured by the cross hairs in the eye piece of the observing telescope. The switch "S" was used to connect the plates with the battery "B" and the droplet would be attracted upwards towards the plate "M" or downwards towards the plate "N", depending on which of these two plates was positive and whether the droplet "P" had a positive or negative charge. It was found that the droplet usually had an electrical charge, produced by friction in the atomizer. If switching on the battery made the drop fall faster it could be sent upwards by reversing the battery by means of a commutator "C".

Now the size of the drop could be determined from the density of the oil, and the velocity with which it would fall when the plates "M" and "N" were uncharged. Then from the velocity with which it moved upwards when the plates were electrically charged, and the weight of the droplet, it was possible to compute the magnitude of the electrical charge on the droplet. Having found the charge, this charge was increased or diminished by one or more negative or positive ions. This was done by means of the X-ray tube, "X" which was used to produce ionization in the air between the plates "M" and "N". After a short time the oil droplet would capture one of the ions produced, and its speed would change immediately, depending on whether it had picked up an electron or a positive ion or perhaps more than one. On again determining the magnitude of the charge on the droplet from the change in speed, we could tell how much electricity had been added to the drop by the captured ion, which would give the amount of electricity in a single electron. The final result of Professor Millikan's measurements is that the charge on an electron is given by

$$e \quad 1.592 \times 10^{-19} \text{ coulombs}$$

or there are 6.282 million million million electrons in a coulomb of electricity.

The most wonderful part of the story of Professor Millikan's measurements is the fact that although measurements were made on a great number of drops, it was found that all of the electrons had exactly the same charge. The experiments took place during a period of several years, and the greatest

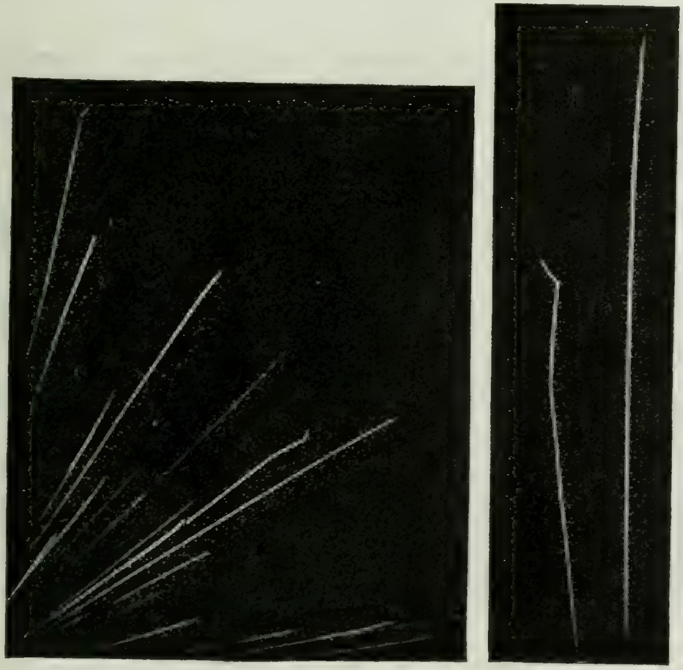
pains were taken to use all of the precautions, and care, and skill, that modern science could suggest. Time was spent eliminating all sorts of errors, and it was thought that an accuracy of two parts in a thousand was attained. To realize what this means, suppose we consider a parallel case. If we were to order a carpenter to make a board 15 inches square, he would need to make the board accurate to wtihin one hundredth of an inch, in order to make the board to the degree of accuracy attained in the measurements of these tiny electric charges.

After the charge on a single electron had been determined with such accuracy, it was possible to use this knowledge in determining a great many other quantities. For instance, we could determine the number of molecules in a given volume of gas, say a cubic centimeter. I will not go into the details of how this is done, but will simply state that in separating water into hydrogen and oxygen by means of electric current, we can measure the amount of hydrogen evolved by a certain measured quantity of electricity, and knowing the electric charge carried by an electron, (which is equal to the charge on a hydrogen atom) we can determine the number of molecules. In this way it is found that there are 27 million million million molecules in a cubic centimeter of air or any other gas at standard temperature and pressure. The measurement of the amount of electricity in an electron and the number of molecules in a cubic centimeter of a gas have been determined by many other methods, and while there is a close agreement in the numbers obtained by different methods, there is no doubt that these measurements of Professor Millikan are by far the most precise that have ever been made, and that the numbers he has obtained will remain our standard for many years to come.

CONCEPTION OF THE ATOM.

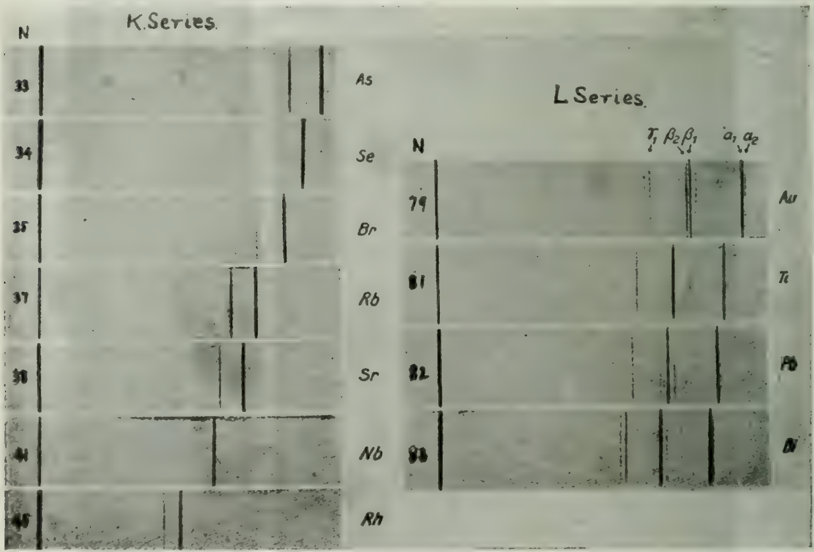
In the experiments which we have so far considered, it has been shown that electricity is associated with matter, and there is very clear evidence that electricity consists of particles, about which we have been able to find out a good deal. I am now going to show how the conception of atoms as shown in Fig. 4 was arrived at. Sir J. J. Thomson from studies on the conduction of electricity through gases, had quite a different idea. He conceived of the atom as having a positive nucleus as large as the atom itself, the negative electrons being embedded in this positive nucleus like plums in a plum pudding. Sir Ernest Rutherford however, from his researches in radioactivity, thought of the atom as a body with a very small nucleus surrounded by electrons. This view received very material support from some photographs taken by C. T. R. Wilson in 1911. These photographs (see fig. 14) show the trails of alpha particles through moisture laden air. Under suitable conditions the trail of the ions produced by the passage of an alpha particle through the air is marked by a fine line of water drops. The alpha particle shooting at an enormous speed, dislodges electrons from the molecules of air, and the ions thus formed serve as centers for the formation of drops of water. It will be seen that these particles shoot through millions of molecules of air without being deviated from their courses. The atoms of air consisting as they do of a relatively massive central nucleus, having extremely light electrons revolving around it, will offer no resistance to the passage of an alpha particle unless it should strike the nucleus; occasionally there is a sudden bend through a rather large angle caused by striking a nucleus. The photograph shows an alpha particle going through 3 inches of air before striking a nucleus,

and photographs have been taken of an alpha particle going through more than 4 inches of air before striking a nucleus. These photographs by showing how the nucleus of an atom could bend the path of an alpha particle, supported the results obtained by Professor Rutherford on the scattering of alpha particles by thin films of metals. It had been noticed that after a beam of alpha particles had passed through a thin film of metal, the beam was broader than it was when it entered. This was due to the nuclei of the atoms of metal in the film bending the paths of the alpha particles. Some of the alpha particles were deflected through very large angles and in some cases even reflected back towards the direction from which they came. Two of Rutherford's pupils, Marsden and Geiger, measured the angles through which alpha particles were thrown back from films of different metals, and Rutherford from certain theoretical considerations was able to show from these measurements that the charge on the nuclei of the atoms of the metals experimented upon, was approximately equal to one half the atomic weight of the element. This led the way to experiments by Moseley on X-ray spectra, which showed the relation between the atomic weight and the charge on the nucleus, or what is the same thing the number of electrons surrounding the nucleus.



(Fig. 14)

Moseley's remarkable work on X-ray spectra stands as a monument to this brilliant young Englishman, who sad to relate was shot to death in the trenches in the summer of 1915 at the age of twenty-seven. Moseley found a very simple relation between the atoms of different elements, and the arrangement of the electrons in them. His discoveries were based on measurements of the wave-lengths of X-ray emitted by different substances. As we have seen already, X-rays are really a kind of light; that is to say, they are vibrations in the ether, just as light waves and electric waves are. Electric waves differ from light waves only in having a much longer wave-length, and similarly X-rays have a much shorter wave-length. If we allow white light to fall on a diffraction grating which is a piece of polished metal on which are scratched very fine parallel lines, the reflected light will be spread out into



(Fig. 15)

a band of colours. This is due to the spaces between the lines being comparable with the wave length of the light, which causes the light rays to be bent or deviated. As the deviation is greater for the longer wave-lengths, the white light is broken up, and we have a band of colours, the longer red waves being deviated the most, and the shorter violet waves the least. The distance from line to line in these gratings is commonly 1/14000 of an inch or less and this is found satisfactory for light waves. As X-rays, however, have a wave-length about 1/10,000 as great as the wave-length of light waves, it is not found possible to rule a grating of sufficient fineness for use with them. It has been found, however, in recent years that since the molecules in a crystal are arranged in rows, and have a regular spacing, a crystal provides a natural grating having sufficiently narrow grating space for satisfactory use with X-rays.

Turning now to the X-ray tube shown in Fig. 11 you will remember that the X-rays were generated through the bombardment of the anti-cathode with electrons. It is found that in using different metals for the anti-cathode, that different sorts of X-rays are emitted depending on the metal of which the anti-cathode is composed. Moseley took X-ray photographs by means of a crystal grating, and found a very simple relation between the wave-lengths of the X-rays emitted and the atomic weight of the element. I have here a photograph showing spectra as they are called, of X-rays of several different metals (fig. 15). They are arranged in the order of their atomic weights, and you will notice a corresponding difference in the wave-lengths, which as previously stated, are proportional to their deviations. From certain theoretical considerations it was possible to show that the differences in wave-lengths were produced according to the number of electrons surrounding the nucleus of the atom. It was found that the hydrogen atom contained only one outer electron, that the atom of helium had two, the atom of lithium three, and

THE ELEMENTS, THEIR ATOMIC NUMBERS, ATOMIC WEIGHTS, AND CHEMICAL POSITIONS

1 H
1.008

0	I	II	III	IV	V	VI	VII	VIII
2 He 3.99	3 Li 6.94	4 Be 9.1	5 B 11.0	6 C 12.00	7 N 14.01	8 O 16.00	9 F 19.0	
10 Ne 20.2	11 Na 23.00	12 Mg 24 32	13 Al 27.1	14 Si 28.3	15 P 31.04	16 S 32.06	17 Cl 35.46	
18 A 39.88	19 K 39.10	20 Ca 40.07	21 Sc 44.1	22 Ti 48.1	23 V 51.0	24 Cr 52.0	25 Mn 54.93	26 Fe 27 Co 28 Ni 55.84 58.97 58.68
....	29 Cu 63 57	30 Zn 65 37	31 Ga 69 9	32 Ge 72.5	33 As 74 96	34 Se 79.2	35 Br 79.92	
36 Kr 82.92	37 Rb 85 45	38 Sr 87 63	39 Y 88.7	40 Zr 90.6	41 Nb 93 5	42 Mo 96.0	43—	44 Ru 45 Rh 46 Pd 101.7 102.9 106.7
....	47 Ag 107 88	48 Cd 112 40	49 In 114 8	50 Sn 118.7	51 Sb 120.2	52 Te 127.5	53 J 126 92	
54 X 130.2	55 Cs 132 81	56 Ba 137 37	57 La 58 Ce 139 0 140 25	59 Pr 140.6	60 Nd 144 3	61–62 Sm 150 4	63 Eu 152	64 Gd 65 Tb 66 Ds 157 3 159 2 162 5
67 Ho 68 Ev 69 Tu 70 Yb 71 Lu 72— 163.5 167 7 168 5 173 5 175 0					73 Ta 181 5	74 W 184 0	75—	76 Os 77 Ir 78 Pt 190.9 193.1 195.2
....	79 Au 197.2	80 Hg 200 6	81 Tl 204 0	82 Pb 207 20	83 Bi 208 0	84 Po (210.0)	85—	
86 Em (222.0)	87—	88 Ra 226 0	89 Ac (227)	90 Th 232.15	UrX2 (234)	92 Ur 238 2	....	

(Fig. 16)

so on up to uranium, whose atomic weight is the highest of all the known elements, and which has 92 negative electrons in its atom grouped around a nucleus having a positive charge 92 times as great as the charge on a single electron.

It will be seen from the foregoing that it is only possible to have 92 elements from hydrogen to uranium. Of these all but 6 are already known. If we arrange the elements in a table according to their atomic weights, as was done many years ago by the Russian chemist, Mendeleeff we shall have a table which will agree with a table of elements arranged according to their electronic numbers. The six highest in the list are the radio-active elements. (Fig. 16.)

RECENT RESEARCHES.

Recent researches of Rutherford go to show that the nucleus of the nitrogen atom contains hydrogen atoms. He finds that by bombarding nitrogen gas with alpha particles from a disintegration product of radium known as radium C, that hydrogen atoms are knocked out of the nitrogen atoms. Sir J. J. Thomson by means of his positive ray analysis has been able to measure the atomic weight of single atoms. He found that the atomic weights of the elements were whole numbers, but that atoms of the same substance had in some cases several different atomic weights. Thus the gas neon whose atomic weight determined by chemists from measurements on a quantity of the gas was given as 20.2, was found by Thomson's measurements on single atoms to consist of two kinds of atoms of atomic weight 20 and 22 respectively. Soddy had previously given the name of isotopes to substances having the same chemical properties, but different atomic weights. Aston repeating Thomson's measurements in a very careful manner was able to verify Thomson's results. Experimenting on a great many different substances he found their atomic weights to be all whole numbers except in the case of hydrogen whose atomic weight he found to be 1.008 just as chemical methods had shown it to be. Some substances he found had a number of isotopes, for instance krypton whose atomic weight given as 82.92 is found to consist of isotopes having atomic weights 78, 80, 82, 83, 84, and 86. It is thought that since the masses of the atoms are whole numbers that the nuclei of the various atoms except hydrogen are made up of helium atoms. Thus the nucleus of oxygen of atomic weight 16 is made up of four helium atoms, carbon atomic weight 12 is made up of three helium atoms, and nitrogen of atomic weight 14 is made up of three helium atoms and two hydrogen atoms. Whether this be true or not we know at least that the elements of highest atomic weight such as uranium, ionium, radium, niton, etc., all emit helium atoms from their nuclei. The nucleus of the helium atom itself is thought to be composed of four hydrogen nuclei and two electrons, the resultant positive charge being counterbalanced by two other electrons which as we have already seen surround the nucleus. The discrepancy between the mass of four hydrogen nuclei (4 times 1.008), and the mass of the helium nucleus (4), is acounted for by the four hydrogen nuclei being closely packed with the two electrons in the helium nucleus. Theory indicates that this close packing would lead to such a reduction in mass.

In concluding I would like to call attention to the extremely important results that have followed from work of a purely scientific nature, pursued with no material end in view. Investigations of the electric discharge through gases carried on with the sole object of widening our field of knowledge led to the unexpected discovery of X-rays, from which followed the even more startling discovery of radium. Both of these discoveries have been of incalculable benefit to mankind. In studying the electron, scientific workers have made not only a wonderful extension to our knowledge of the atoms of substances, but have also made possible the invention of the electron tube, which is of such great practical importance that it has virtually created an entirely new branch of engineering.

THE PRESIDENT:—Gentlemen, we with Mr. Cartmel, must regret that we are not able to hear all that he had to tell us, but it is of course only fair to point out that we have allotted to him the hour indicated in the paper, which includes discussion, so that the actual allotment has been somewhat in excess of that indicated in the programme. The only trouble is, the speaker had really too many things of interest which he had to show us. So far as the present speaker is concerned, he feels that you are all in agreement with him, that what we have listened to has been of entrancing interest.

TABLE OF RELATIVE MAGNITUDES ILLUSTRATING STATEMENTS MADE IN THE PRECEDING PAPER

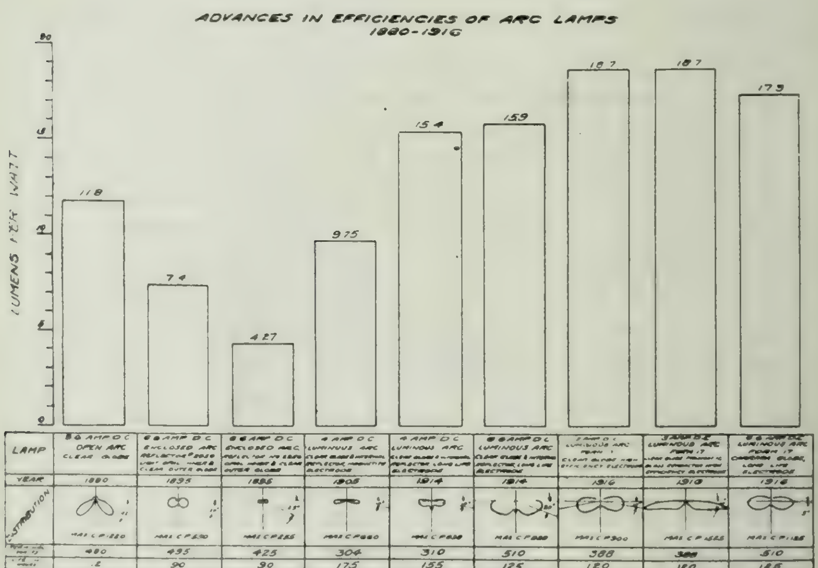
Wave length of sodium light (D_1)	$5896. \times 10^{-8}$ cm. (roughly between 1/40000 and 1/50000 of an inch)
" " " shortest visible violet light	$3934. \times 10^{-8}$ cm.
" " " " ultra violet light, measured by Fricke & Lyman	$585. \times 10^{-8}$ cm.
" " " X rays from zinc	12.3×10^{-8} cm. (characteristic L radiation)
" " " X rays from lead	0.14×10^{-8} cm. (characteristic K radiation
" " " hard gamma rays	0.07 to 0.03×10^{-8} cm.
Diameter of helium atom (or molecule)	1.7×10^{-8} cm.
" " hydrogen molecule.	2.1×10^{-8} cm.
" " oxygen molecule.	2.4×10^{-8} cm.
" " electron.	0.000037×10^{-8} cm.
Mass of Hydrogeu Atom.	1.662×10^{-24} gramme
Mass of an Electron.	$.000906 \times 10^{-24}$ gramme
Number of electrons in one coulomb.	6.282×10^{18}
Number of molecules in 1 c.c. of a gas at normal temperature and pressure.	27.03×10^{18}

Next paper is on "Modern Street Lighting," with lantern slides, by Mr. A. B. Cooper, Canadian General Electric Co., Toronto.

MODERN STREET LIGHTING.

By A. B. Cooper.

The subject assigned for this paper, "Modern Street Lighting", is sufficiently broad to cover all forms of illuminants for street lighting purposes. There are in service in Canada today literally hundreds of inherently



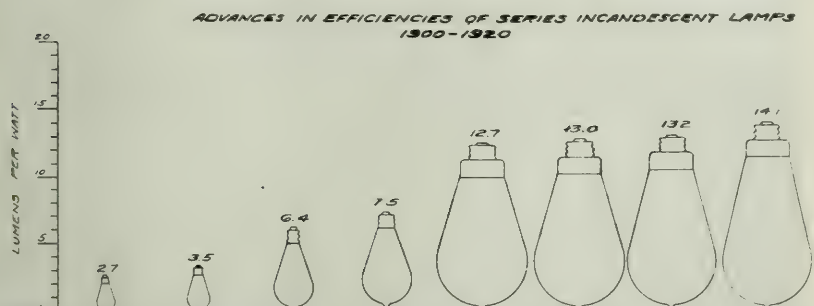
(Fig. 17)

different arrangements of street lighting units. Very few of these installations approach the maximum efficiency obtainable for the particular conditions involved. The variation in efficiency and operating characteristics among some of the systems now in service is of sufficient interest, I think, to warrant brief comment, and I have prepared a slide showing some comparative values both for arc and incandescent units. (Figs. 17 and 18.)

These comparative figures are of individual lamp values which we may assume are fairly representative of the best values obtainable during the development of the art in the periods covered, extending roughly from 1886 for the arc lamps and from 1900 for the incandescent.

The comparative values are still further distorted by the methods employed in mounting and housing the light source. In the early days of the open arc there was no attempt at diffusion—the lights weer spaced far apart, usually at street intersections, and presented spots of local brilliancy and intervening spaces of semi-darkness. This illumination was wholly silhouette, and anyone driving at night time from the centre of town toward the outskirts or into the country drove, after passing the last arc lamp, into a wall of inky blackness. The ratio between the maximum and minimum intensities on the street surface was several hundred to one.

In all later types some attempt has been made to introduce diffusion, and at the same time the designers have endeavored to so arrange the unit as

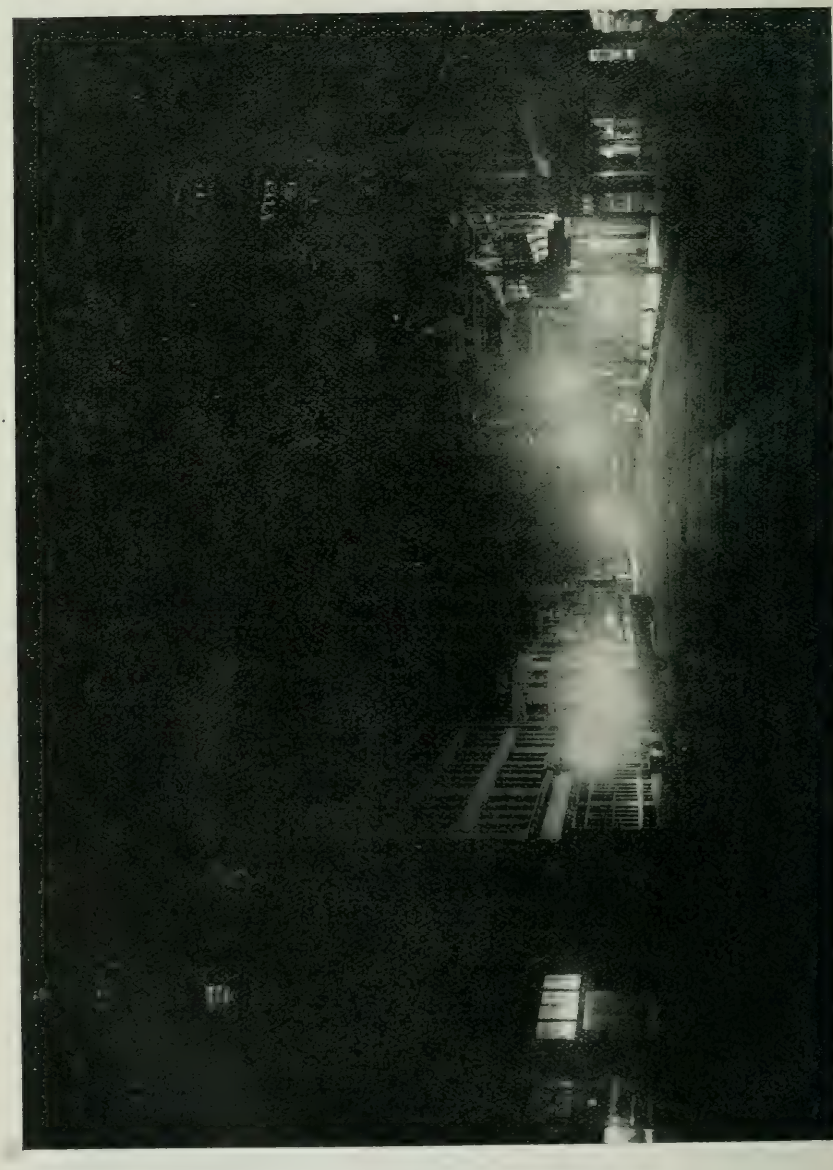


CANDLE POWER	125	125	80	350	1000	1000	1000	1000
WATTS	440	324	114	413	544	544	544	544
DISTRIBUTION	MAX CP 117	MAX C P 153	MAX C P 102	MAX C P 433	MAX C P 925	MAX C P 2290	MAX C P 605	MAX C P [illegible]
LAMP	CARBON	GEM	TUNGSTEN	MAZDA	MAZDA	MAZDA	MAZDA	MAZDA
FILAMENT	CARBON	METALLIZED	TUNGSTEN	TUNGSTEN	TUNGSTEN	TUNGSTEN	TUNGSTEN	TUNGSTEN
EQUIPMENT	PARABOLIC DEFLECTOR	20 RADIAL WAVE REFLECTOR	20 RADIAL WAVE REFLECTOR	24" RADIAL WAVE REFLECTOR	FORM 6 NOVALUX PENDENT UNIT, LIGHT CARRARA GLOBE [illegible] 20" STEEL REFLECTOR [illegible]	FORM 6 NOVALUX PENDENT UNIT NEW BOWL TYPE PRISMATIC GLASS REFRACTOR REFLECTOR [illegible]	FORM 6 NOVALUX PENDENT UNIT, LIGHT CARRARA GLOBE NO. 87	FORM 6 NOVALUX PENDENT UNIT PRISMATIC GLASS BAND REFRACTOR STEEL REFLECTOR [illegible]
YEAR	1900	1905	1908	1911	1920	1920	1920	1920
LIFE	250	450	1350	1350	1350	1350	1350	1350

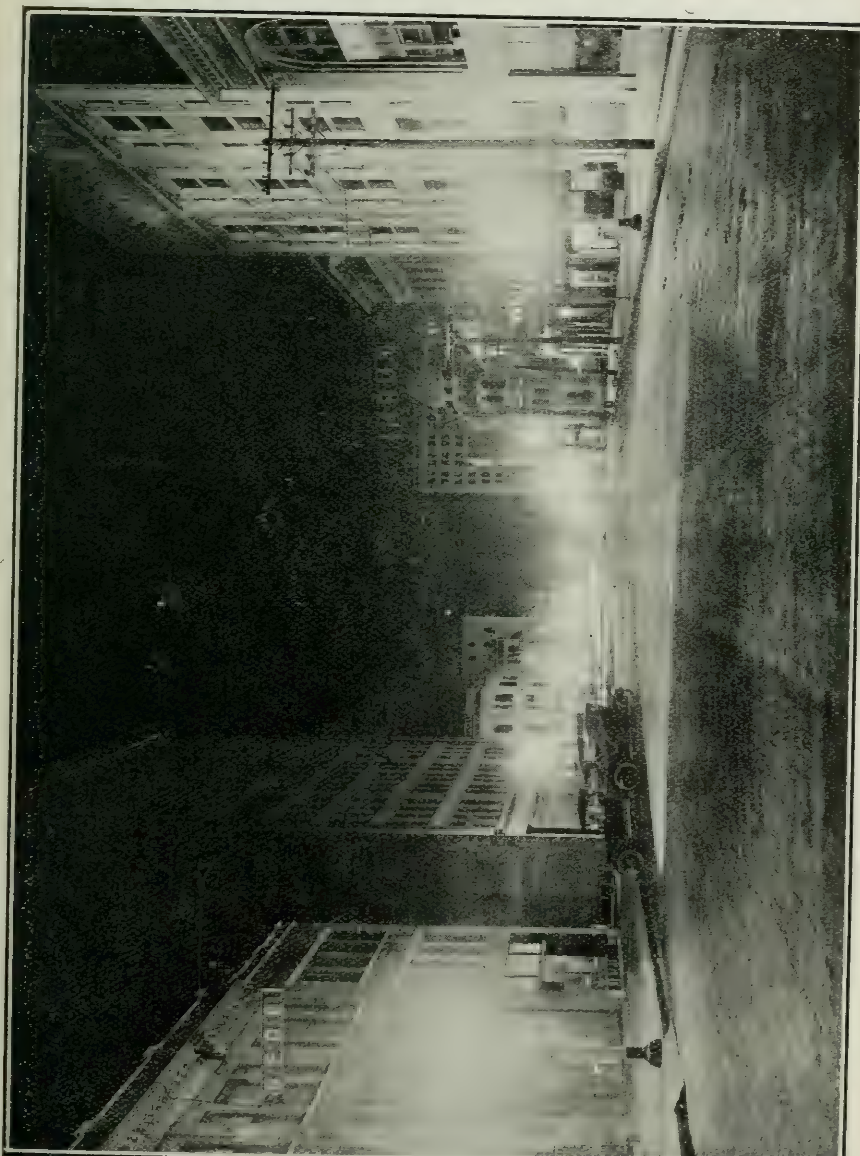
(Fig. 18)

to develop the maximum candlepower value at an angle more nearly approaching the horizontal. This has an important effect on the average intensity of the illumination, as tends to spread out the light between centres. This feature is obvious from a consideration of photometric curves of the representative units shown, but the general change in illumination will be better appreciated by comparing two night view photographs (Figs. 19 and 20) taken same street with the same time exposure in each case.

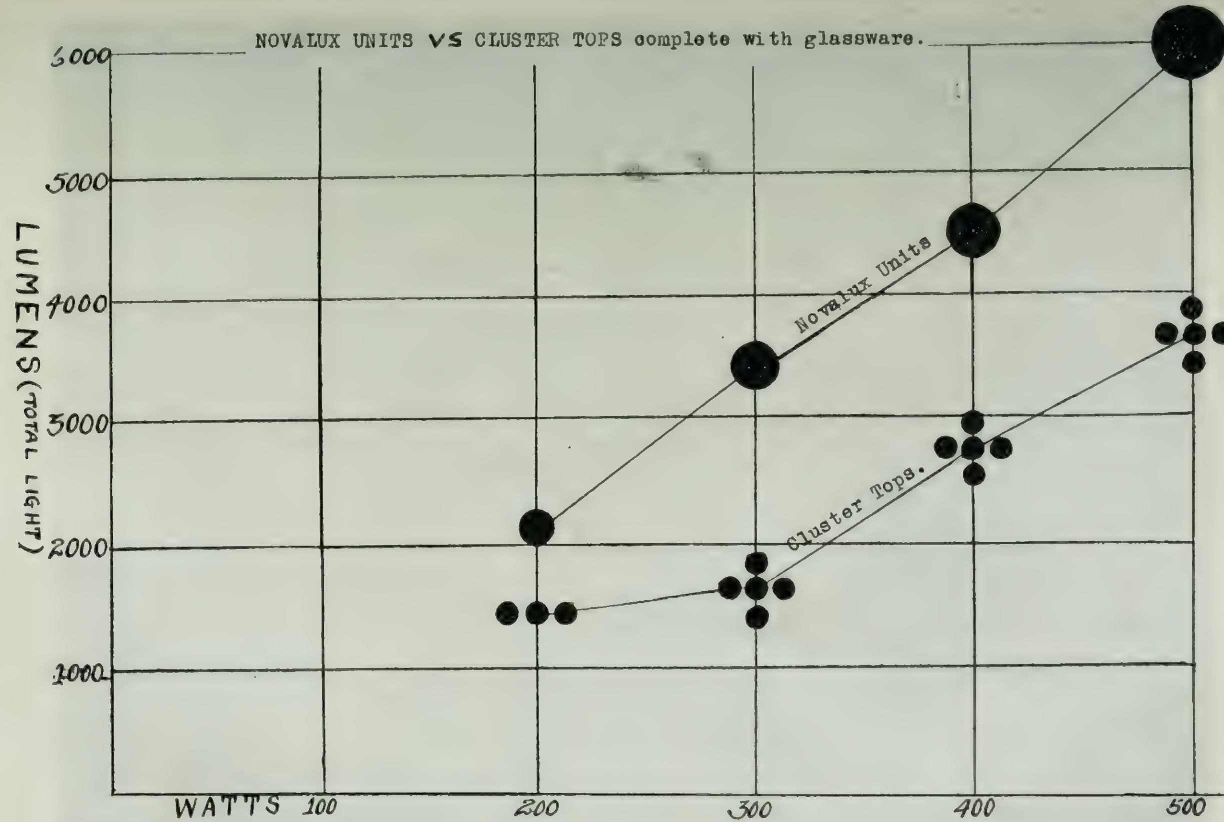
These happen to be luminous arc installations, but the White Way photograph is typical of either an uptodate luminous arc or series incandescent installation in so far as street surface illumination is concerned. To get anywhere near the same foot candle value on the street surface with incandescent lamps it would be necessary to utilize reflectors and refractors, with the result that the upper fronts of the buildings would be in comparative darkness.



Main street, Oklahoma City, Oklahoma, before the installation of Ornamental Lumious Arc Lamps.
(Fig. 19)

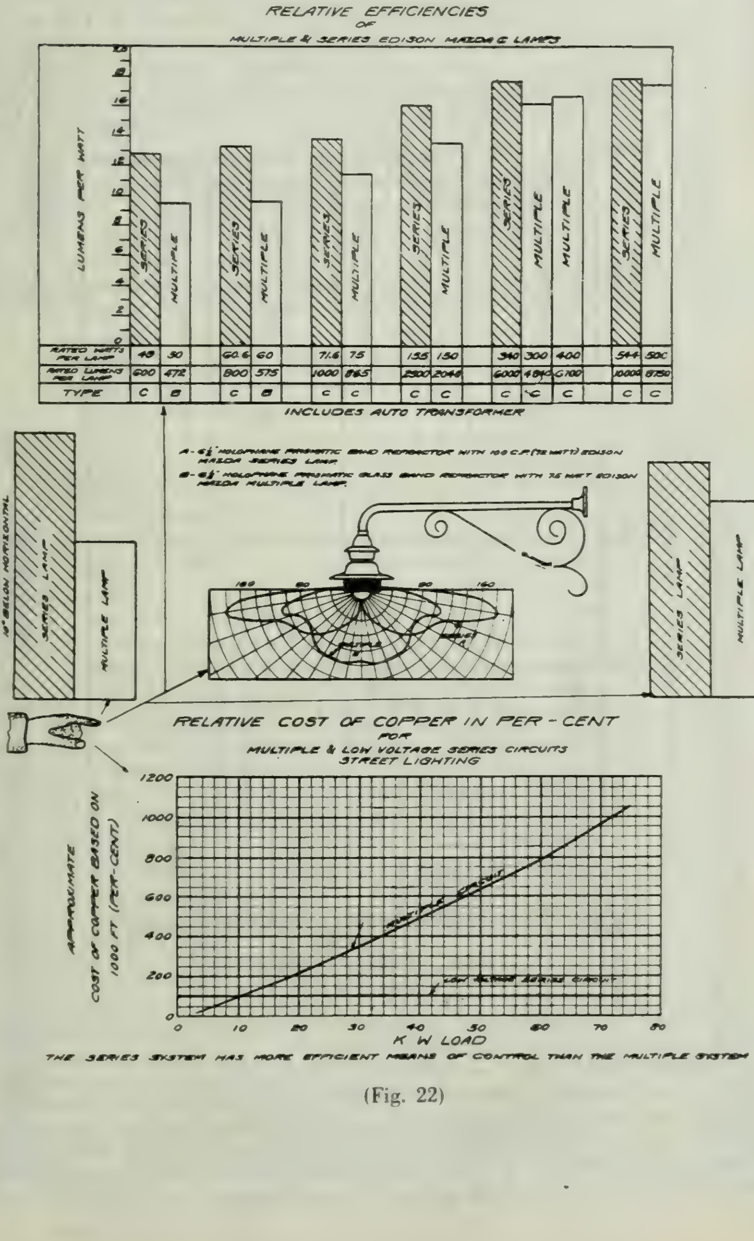


Ornamental Luminous Arc Lamp, Oklahoma City, Okla.
(Fig. 20)



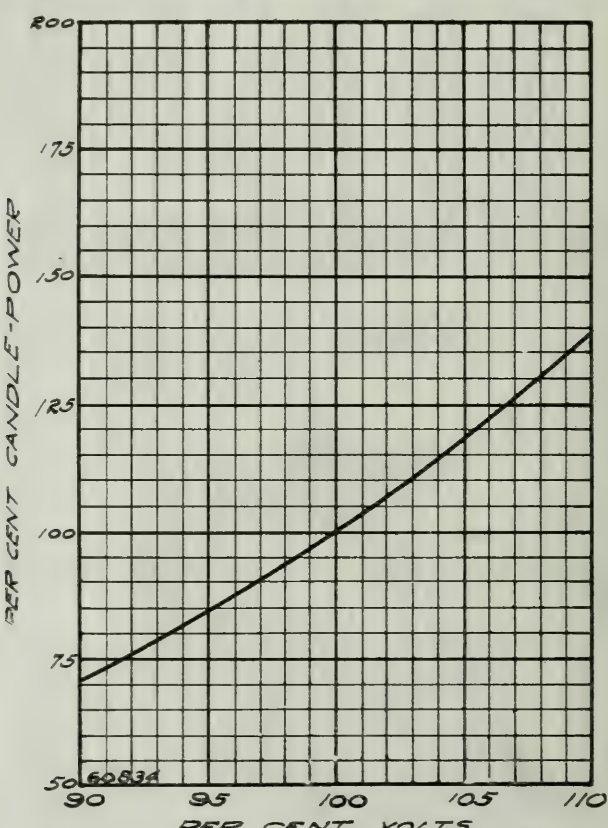
C-1105

CHART 3.
(Fig. 21)


RELATIVE EFFICIENCIES
OF
MULTIPLE & SERIES EDISON MAZDA C LAMPS
LUMENS PER WATT
SERIES
MULTIPLE
RATED WATTS PER LAMP
RATED LUMENS PER LAMP
TYPE
INCLUDES AUTO TRANSFORMER
CANDLE-POWER 10° BELOW HORIZONTAL
SERIES LAMP
MULTIPLE LAMP
TOTAL LUMENS PER WATT
RELATIVE COST OF COPPER IN PER-CENT
FOR
MULTIPLE & LOW VOLTAGE SERIES CIRCUITS
STREET LIGHTING
APPROXIMATE
COST OF COPPER BASED ON
1000 FT (PER-CENT)
MULTIPLE CIRCUIT
LOW VOLTAGE SERIES CIRCUIT
K W LOAD
THE SERIES SYSTEM HAS MORE EFFICIENT MEANS OF CONTROL THAN THE MULTIPLE SYSTEM

(Fig. 22)

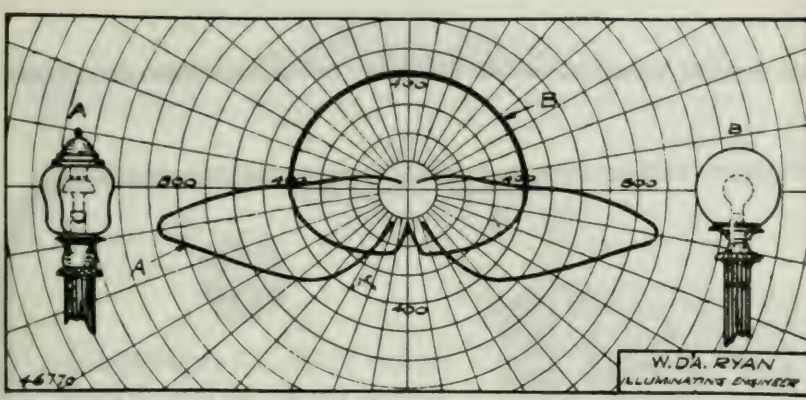
With the development of the incandescent lamp there has been a quite general use of cluster arrangements, particularly with multiple installations. The combination of multiple lamps and cluster groups results in a forty to fifty percent reduction in efficiency on the basis of watts to foot candles. Within the last two years there has been a general tendency to take out the cluster installations and install instead single unit pole top fixtures. With this change, the average intensity on the street surface can be approximately doubled using the same amount of electrical energy. These comparative values

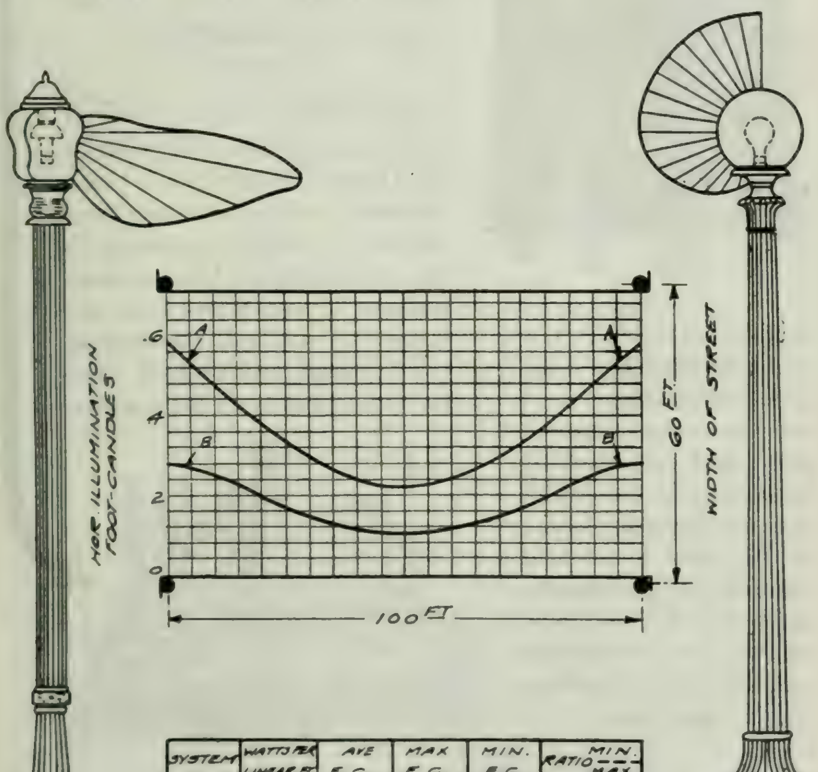


(Fig. 23)

are indicated by Figs. 4 and 5 showing the cluster feature and the multiple versus series comparisons separately.

Multiple single light installations are still receiving favorable consideration in some localities where special conditions obtain. In such places it is usually found that some existing arrangement in connection with the lighting, or house distribution, makes it cheaper from the standpoint of first cost to install multiple units. In such comparisons, however, the copper for the multiple system is figured on a basis to give from five to ten percent drop





SYSTEM	WATTS PER LINEAR FT.	AVE F C	MAX F C.	MIN. F.C.	RATIO MIN./MAX
A	6.6	.360	.580	.230	.400
B	6.6	180	.280	.106	.380

(Fig. 24)

to the end of the circuit. This will result in a decrease of from fifteen to thirty percent in the illumination from the end lamps. If the voltage is increased to compensate for this, then the lights at the centre will burn at over voltage with an even greater reduction in lamp life. Furthermore, unless the multiple lights are fed from a circuit controlled by induction regulators or some similar means, there will be a daily variation of even greater calibre affecting all lamps on the circuit. In nine cases out of ten the variable voltage circuits reach their maximum after 11.00 to 12.00 p.m., when the extra light is not needed.

Toronto is lighted entirely by the multiple system. Experience with this installation has justified the expenditure of many thousands of dollars to provide special bucking transformers which are cut in on all the street lighting feeders at midnight, to compensate in part for the system increase in voltage during the early morning hours. Fig. 23 shows the approximate reduction in candlepower resulting from reduced voltage.

It might be interesting to mention that Toronto is also gradually substituting single light standards for the five-light clusters in the down town section, at the same time raising the height of the light centre. On some of the more important uptown streets they have raised the single unit lamps several feet and have put in higher candlepower lamps with top reflectors.

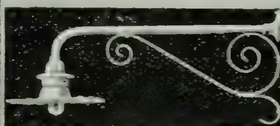
This experience, which is typical of many in the States, should be sufficient warning against the false economy of installing a small candlepower unit, using low mounting heights to increase the intensity on the street surface. This brings the light source down into the line of vision and contracts the pupil of the eye so that the advantage of the increased intensity is lost. With higher mounting it is possible to largely offset the increased cost of the larger illuminant by increasing the distance between mountings. It is not possible to make any standard recommendation for height of mounting because of the variable quantities which must be considered in each installation. Each individual case should be worked out in relation to the width of street, candlepower, spacing between lamps, tree interference, type of refractor used, etc. About fifteen or sixteen feet may be considered an average value to-day compared with ten to twelve feet a few years ago. Some important installations have recently been made in the States, using high candle power units mounted twenty-five feet or more above the street surface.

As affecting the question of spacing and height of mounting, it is important to study the ratio of maximum to minimum illumination. All these factors are related to each other. In ornamental installations relying on some form of opal or moonstone globes for diffusion, it is customary to figure a spacing approximately seven times the mounting height, which arrangement on a street or ordinary width will give a ratio of ten to one between maximum and minimum illumination.

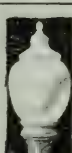
With the more modern prismatic refractors, the spacing is usually increased to approximately eight times the mounting height and with a properly selected refractor the uniformity ratio is improved to approximately five to one. This advantage with refractor units has been obtained by developing the angle of the refractor cutting to give the maximum distribution at an angle approximately ten degrees below the horizontal. This feature is clearly shown in Fig. 24 comparing the photometric curves of fixtures with and without refractors.

WHAT TYPE OF FIXTURES ARE AVAILABLE FOR STREET LIGHTING & CLASS OF SERVICE BEST SUITED FOR?

ANS

UNIT	 ADAPTABLE FOR 60 TO 250 C P LAMP	 ADAPTABLE FOR 60 TO 250 C P LAMP	 ADAPTABLE FOR 250 - 600 C P LAMP
EQUIPMENT	DOME RADIAL WAVE REFLECTOR	BAND REFRACTOR & CANOPY HOLDER	
LOCATIONS	OUTLYING DISTRICT	OUTLYING DISTRICT & ROADWAYS	RESIDENCES
SUSPENSIONS	15 FT - 18 FT	15 FT - 18 FT	20 FT 25 FT
SPACINGS	50 FT - 200 FT	50 FT 200 FT	100 FT - 300 FT

UNIT					
	ADAPTABLE FOR 250 C P TO 1000 C P LAMP				
EQUIPMENT	BOWL REFRACTOR & REFLECTOR	BAND REFRACTOR & REFLECTOR	DOME REFRACTOR & RIPPLE GLOBE	DOME REFRACTOR & RIPPLED GLASS GLOBE	DOME REFRACTOR & 8 PANEL RIPPLED GLASS GLOBE
LOCATIONS	HIGHWAYS	HIGHWAYS	HIGHWAYS	RESIDENCES, PARKS, BOULEVARDS	
SUSPENSIONS	20 FT - 30 FT	20 FT - 30 FT	20 FT 30 FT	12 FT 15 FT	12 FT 15 FT
SPACINGS	300 FT - 500 FT	300 FT - 500 FT	300 FT - 500 FT	100 FT - 200 FT	100 FT - 200 FT

UNITS			 *		 *
	ADAPTABLE FOR 250 C.P. TO 1500 C P LAMP				
EQUIPMENT	DIFFUSING GLASS GLOBE				
LOCATIONS	BUSINESS CENTERS & IMPORTANT SIDE STREETS				
SUSPENSIONS	15 FT	15 FT	12 FT - 20 FT	12 FT - 20 FT	12 FT - 20 FT
SPACINGS	80 FT - 200 FT	80 FT - 200 FT	80 FT - 200 FT	80 FT - 200 FT	80 FT - 200 FT

* LUMINOUS ARC LAMP UNIT HAS SAME EXTERNAL APPEARANCE AND IS RECOMMENDED WHERE LOCAL CONDITIONS ARE FAVORABLE

FILE NO. 4233
CHECKED BY H.E.B.
INSPECTED BY S.L.E.R.
SEPT 3, 1920

W. D'A. RYAN
ILLUMINATING ENG. LABORATORY
GENERAL ELECTRIC CO
SCHENECTADY, NY
C-60789

(Fig. 25)

A very satisfactory fixture for either ornamental or pendant use is obtained by combining an internal dome refractor and an enclosing globe of clear or opal flashed rippled glass. The refractor units are made up of two nested sections with the rough prismatic surfaces on the inside, leaving the inside and outside of the assembled unit perfectly smooth, to prevent the accumulation of dust and dirt.

Fig. 25 shows, grouped together, a number of representative fixtures suitable for various zones. Many cities and towns make the mistake of investing all the available money and directing all the municipal energy toward a high intensity illumination of the main street or streets, leaving the side streets in comparative darkness. I know of one city which has a highly efficient high candlepower system on its business streets, while a block away it burns 32 C.P. carbon lamps day and night. The lamps are topped by bent and rusted reflectors (?), serving in many cases as self incubating homes for the appreciative sparrow.

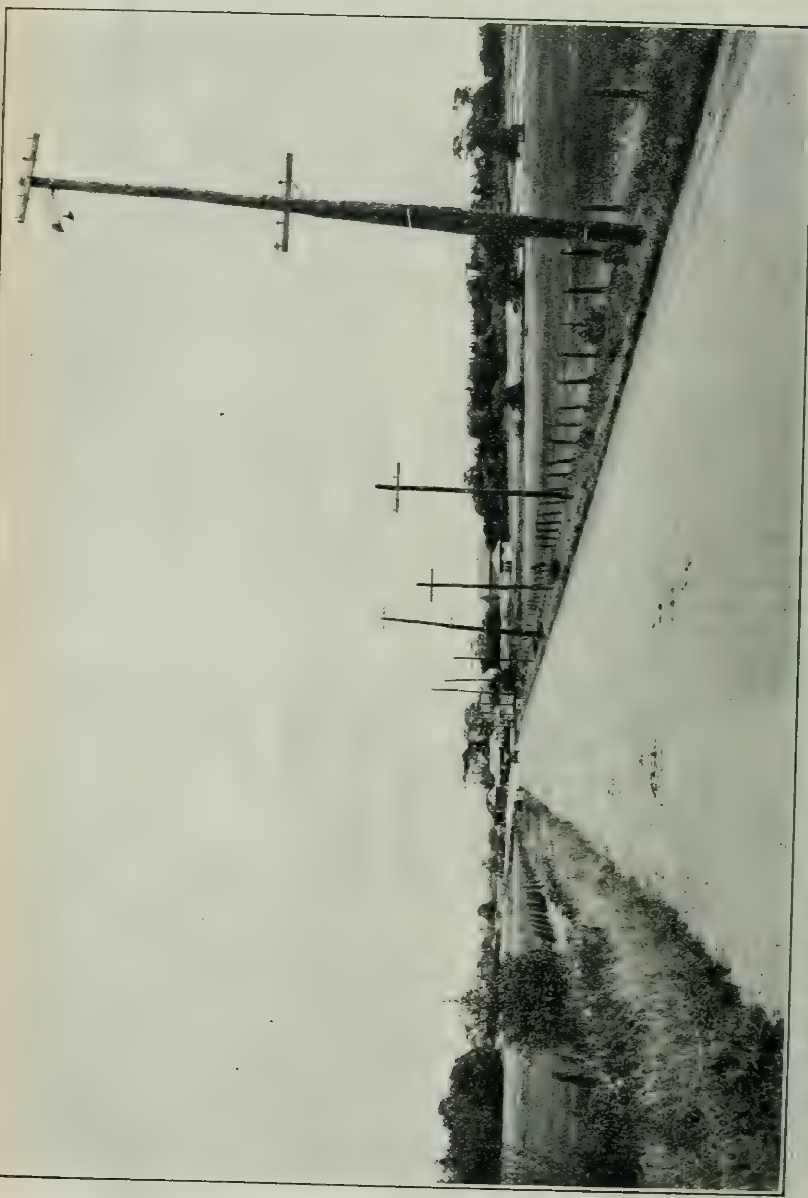
Lighting impresses one as peculiarly akin to good roads in relation to civic pride. Until recently counties have been content to spend all their money on one or two main thoroughfares designated as "county roads," leaving the isolated sections to their own salvation.

We have few cities in Canada that require an illumination intensity in the business section more than fifteen or possibly twenty times full moonlight. For these intensities the luminous arc lamp is still unquestionably the best illuminant on account of its higher efficiency and the sparkling whiteness of its light. It is a mechanical lamp, however, and requires intelligent supervision. The cost of proper supervision is largely independent of the number of lamps installed, so that the economy of the lamp operation is offset in small installations.

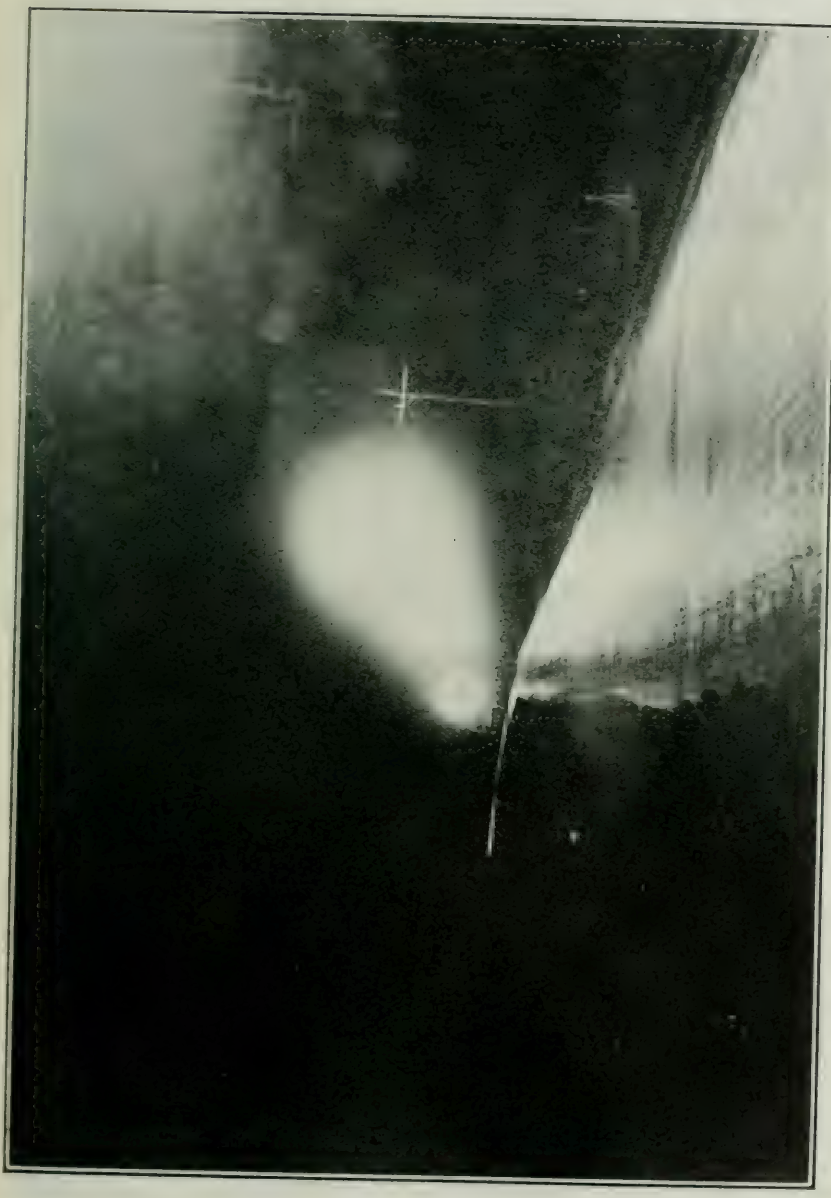
It is my opinion that for installations of less than 100 ornamental units the higher candlepower series incandescent units should be recommended. In cities of 50,000 to 100,000 population, an intensity of approximately ten times full moonlight, (.25 foot candles) should be sufficient for the business section, and half this value should be satisfactory for cities from 10,000 to 50,000.

In the larger cities the residential streets and parkway districts should have average intensities about one-fifth of the business section. The uniformity factor (ratio of maximum to minimum) may, however, be much larger, introducing greater dependence on the silhouette effect for revealing power. For this class of lighting 250 to 600 C. P. lamps with refractors are usually recommended. Centre suspension is widely and properly used for this class on account of tree interference. Short ornamental standards with all globes have been very commonly used for parkway lighting in the past. The application would appear to be entirely wrong, however, as about half the light goes up among the trees, serving no useful purpose and on the contrary tending to keep the birds awake. In many of these installations a very small candlepower lamp is used in the ball globe, giving scarcely enough illumination to light the globe up. I feel that parkway lighting should be arranged to give intensity with elevations and diffusion sufficient to prevent glare, so that motorists can drive safely without their headlights burning.

This thought introduces the question of interurban highway lighting. In the last few years many sections in the States have tried to obtain some economic and satisfactory means of illuminating the motor highways. A large number of 600 C. P. lamps with band refractors have been used with



Day view of Paradise Road Swampscott showing 250 c.p. 4 Amp. Series Highway Lighting Fixture looking West.
(Fig. 26)



Night view of Paradise Road Swampscott showing 250 c. p. 4 Amp. Series Highway Lighting Fixture looking West. (Fig. 27)

fair satisfaction, but their high first cost has prevented their general adoption. Within the last year a special highway unit has been developed, utilizing nested parabolic reflectors designed to direct all the light along the highway. These units are designed for high mounting (30 to 35 ft.) on telephone or telegraph poles at one side of the road. Figs. 26 and 27 show an installation utilizing 250 C.P., 4 ampere lamps with 600 foot spacing.

The general characteristics of this parabolic reflector group require a small compact arrangement of the lamp filament which can only be obtained with series lamps. With the small candlepower lamp required and with the long spacing between units, it is possible to light several miles of highway from a single constant current transformer. Outdoor constant current transformers are now quite commonly in use, mounted on the poles and controlled by automatic time switches. These transformers operate on the moving coil principle, the same as the standard station type constant current transformers. The outdoor transformers are, however, oil cooled units and are supplied with special non-freezing oil. Automatic electrically self winding switches can be obtained, but it is customary to use an eight day hand wound time switch. The weekly winding insures frequent inspection and permits of a regular adjustment of the time dials to compensate for the change in time of sun setting.

The outdoor transformers are designed with a fairly high reactance, so that the lamps may safely be thrown on regardless of the position of the movable coils. This type of transformer is particularly suitable for small town and village installations. There are already a large number in service in Canada.

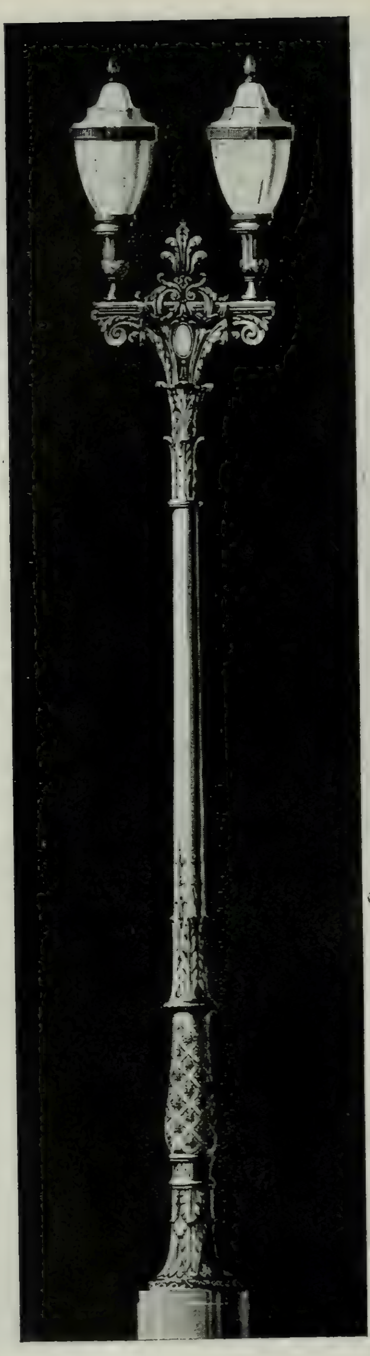
On series A. C. ornamental systems it is now common practice to install some form of supplementary transformer or auto transformer at each lamp, to increase the current from 6.6 amperes to 15 or 20 amperes. This permits the use of a more hardy lamp with a more concentrated filament.

The arrangement that presents the most advantages is to install a separate coil transformer in the base of the pole or buried in the ground beneath the pole. The windings of these series transformers are completely embedded in non-hygroscopic compound, and if desired, they may be rendered still more impervious to the effects of moisture by embedding the transformer and cable approaches in tar before filling in the trench. Installations of this sort have been in service for several years without any sign of trouble. The use of series transformers eliminates the high voltage of the series circuit from the lamp, with considerable reduction in cost of highly insulated cable in the lamp standard.

Series transformers of larger size but the same general characteristics are available for use in supplying small groups of lights where the high voltage of the series circuit is objectionable, as in the case of bridges. They are also used to advantage to supply small candlepower lamps on side streets feeding off of the main circuit supplying the high candlepower lamps in the White Way section.

For the higher candlepower pendant units, a 6.6/20 ampere auto transformer is usually recommended for mounting inside the casing of the lamp itself. It serves the same general purpose as the series transformer, except that it does not insulate the lamp from the high voltage circuit. Both series and auto transformers extend lamp life by impeding the instantaneous voltage surges in the series circuit. Auto transformers can be obtained complete with sockets and supports for mounting in the casings of semi-obsolete A.C. series

San Francisco Cal., Market Street Looking toward Ferry Building.
(Fig. 28)



(Fig. 29)

enclosed arc lamps. A large number of carbon arcs have already been changed over on this basis. The tabulated data on page 119 show the economies in efficiency and operating cost which may be effected by changing from series enclosed arcs to series incandescent units.

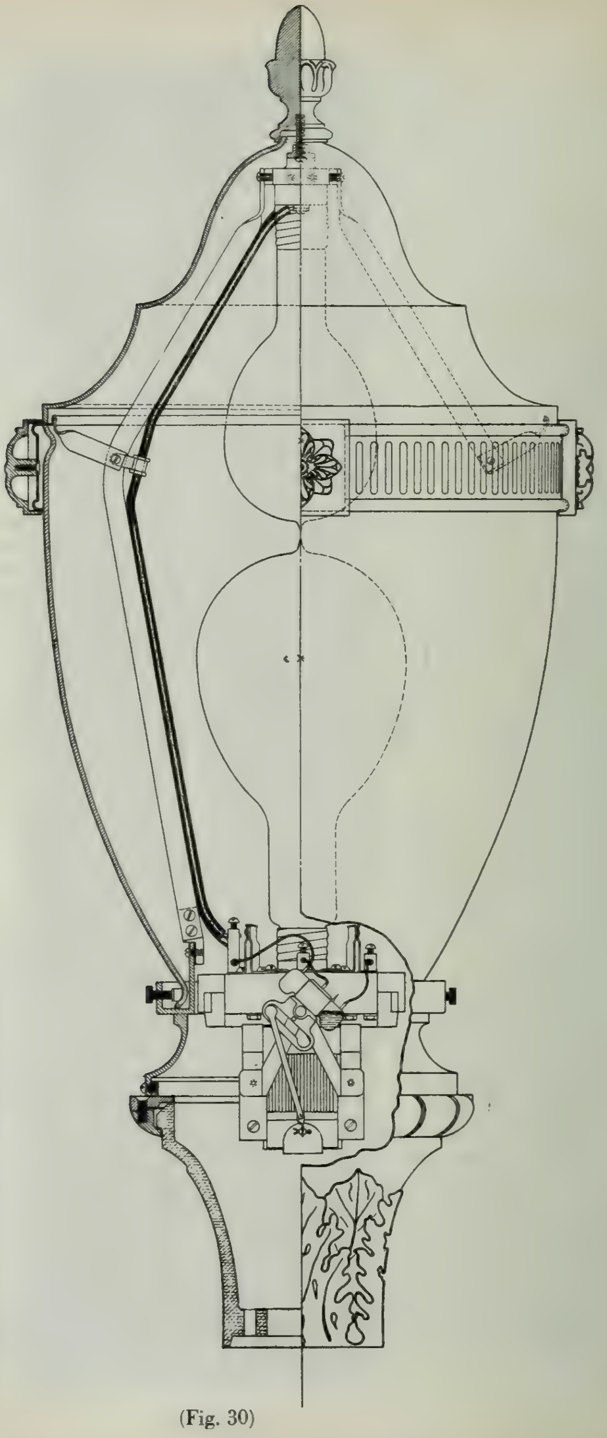
During the last two or three years, some of the cities in the United States have installed down town White Way Systems, utilizing two or three maximum candlepower units on one standard. San Francisco has just completed an installation using 3—6.6 ampere D. C. magnetite luminous arc lamps per standard, with very high mounting. The photograph of Market Street shows the general arrangement of the light groups and the general lighting effect (fig. 28). The D.C. luminous arc still continues to be the outstanding illuminant for White Way and general high intensity lighting. Both Los Angeles and Salt Lake City have only recently completed similar installations, using two luminous arcs per standard.

I have been interested in reading in the advance report of the Illumination Committee of the A.I.E.E. that the sale of luminous arc lamps increased fifty percent in 1919 over 1918.

The nearest approach that series incandescent lighting has made to this type of intensive lighting is at Saratoga Springs, where two 1000 C. P. lamps are installed per standard in the main streets (Fig. 29) and one similar lamp per standard in the residential and parkway sections. This installation is furthermore unique in that the diffusing glassware houses two entirely separate lamps. The main 1000 C.P. lamp burns tip up, supported by a socket at the bottom of the fixture. Directly above this is suspended a 250 C.P. lamp burning tip down (Fig. 30). In the lamp casing there is a small relay which can be operated from the substation by manipulation of the series circuit so as to switch from the 1000 C.P. to the 250 C.P. or vice versa. The change over is made of course at or about midnight, and in fact during certain periods of the year when the resort activities are at a minimum, the 1000 C.P. units are not used at all. The 1000 C.P. unit has no refractor, so that the building fronts are well illuminated. When the smaller lamp is cut in, advantage is taken of a top mounted refractor (not shown in the illustration) to direct practically all the light on to the street surface.

In conclusion I want to direct your attention if possible toward the safety aspect of good street lighting. I have been astounded to read in the A.I.E.E. report previously referred to that during the period of the American participation in the war there were 56,000 American soldiers killed in Europe, whereas during the same period (19 months) 236,000 men, women and children were accidentally killed in the United States. The figure covers reported deaths from all accidental causes, and it is of course impossible to determine what proportion of fatal accidents might have been prevented by better lighting. Certainly, however, it is not too high to assume two percent as a fair figure, which means that nearly 5,000 lives might have been saved by adequate street and industrial lighting.

From the standpoint of the man in the street and the man in the motor, of the central station manager and the Chief of Police, and particularly from the standpoint of the merchant, there can be no argument against better street lighting. There is beginning to be, in Canada, a reawakening of interest in this subject, and I feel that broadly in the interests of the country in general and specifically in the interests of the electrical business, the members of the Canadian Electrical Association should foster and assist this general tendency toward improvement in street illumination.



ASSEMBLY OF DUO-FLUX FIXTURE.
INDEX E-352.7

(Fig. 30)

ELECTRICAL DATA

Type of Unit	6.6 Ampere A-C. Series Enclosed	7.5 Ampere A-C. Series Enclosed	6.6 Ampere D-C. Series Enclosed	Form 6 Novalux 250 C.P.	Form 6 Novalux 400 C.P.	Form 6 Novalux 600 C.P.
Line Amperes	6.6	7.5	6.6	6.6	6.6	6.6
Lamp Amperes	6.6	7.5	6.6	6.6	15	20
Volts at Lamp Terminals	77	77	75	23.4	37.1	51
Watts at Lamp Terminals	425	480	495	155	234	340
Line Loss	5%	5%	5%	5%	5%	5%
Efficiency of Constant-current Tansformer	96%	96%		96%	96%	96%
Efficiency of Brush Arc Generator Driven by Synchronous Motor			86%			
Combined Efficiency	91.2%	91.2%	81.7%	91.2%	91.2%	91.2%
Watts Supplied at Switchboard	468	527	605	170	257	373
Hours Lamps Burn Each Year	4000	4000	4000	4000	4000	4000
Kw-hr. Consumed per Lamps per Year	1872	2108	2420	680	1028	1492
Total Lumens per Lamp:						
With light opal inner globe, clear outer globe, and street reflector	1810	2170	3645			
With light Carrara globe and reflector				1725	2750	4070
with bowl type Holophane prismatic refractor and reflector				1670	2820	4225
With Holophane dome refractor and stippled glass globe				1913	3060	4580
With Holophane band refractor and reflector				1780	3040	4510

SAVING IN KILOWATT-HOURS AND MONEY PER LAMP PER YEAR BY REPLACING ENCLOSED CARBON ARC LAMP WITH NOVALUX UNIT AND MAZDA SERIES LAMP

(Power at 1.5 Cents per Kw-hr.)

	FORM 6 NOVALUX					
	250 c-p.		400 c-P.		600 c-p	
	Kw-hr.	Money	Kw-hr.	Money	Kw-hr.	Money
6.6 Amp. A-c. Series Enclosed Carbon Arc	1192	$17.88	844	$12.66	380	$ 5.70
7.5 Amp. A-c. Series Enclosed Carbon Arc	1428	21.42	1080	16.20	616	9.24
6.6 Amp. A-c. Series Enclosed Carbon Arc	1740	26.10	1392	20.88	928	13.92

The 1000-c-p. lamp is not considered in this table, as its size confines it very largely to high intensity White Way lighting where local conditions preclude installing the luminous arc lamp.

THE PRESIDENT:—We are all deeply indebted to Mr. Cooper for this very interesting talk which he has just given us.

We will now proceed to the next, which is a paper on "Switching Equipment," with lantern slides, by Mr. L. B. Chubbuck, of the Canadian Westinghause Company, Hamilton.

(Mr. Chubbuck delivered lecture which was not sent in time for printing in these proceedings.)

THE PRESIDENT:—Gentlemen, I am sure we are very much indebted for the interesting paper we have just heard.

I may say that as this morning the circumstances scarcely permit of conventional and ceremonious treatment of these papers, this afternoon we may in one inclusive vote of thanks indicate our appreciation for the various papers we have heard this morning.

The next paper will be on "The Manufacture and Testing of High Tension Porcelain Insulators," with lantern slides, by Mr. A. D. Allen, of the A. D. Allen Inspection Co., Hamilton.

Before Mr. Allen comes forward, I should like to say that after this paper we are having moving pictures. They, of course, are intensely interesting.

The luncheon takes place at one o'clock, and I may say takes place on the Terrace. After luncheon, it is proposed to have a photograph of the group taken.

THE MANUFACTURE AND TESTING OF HIGH TENSION PORCELAIN INSULATORS.

(By A. D. Allen.)

It was brought to our attention that most of those engaged in the electrical profession, sales or engineering, have but a vague idea of the processes involved in the manufacture of porcelain insulators.

Upon the suggestion of one of your executives we prepared, illustrated with lantern slides, a brief paper covering the manufacture, inspection and testing of porcelain insulators.

We are dealing with this subject, not as a ceramic engineer, but from our knowledge and experience gained from the inspection of insulators during the last ten years, at the various insulator plants in the States and Canada.

These lantern slides, which we are using to-day, are those which we secured at the Canadian Porcelain Company's plant in Hamilton, and probably represent the latest developments in the ceramic art of making and testing insulators.

The materials generally used in the manufacture of hard porcelain are Ball Clay, China Clay, Feldspar and Flint.

It is the function of Ball Clay to make the mass plastic or workable, the China Clay strong and dense when burned, the Feldspar of a definite fluxing point to render the mass perfectly homogeneous, and Flint to prevent too great shrinkage. All materials must burn white and dense so that the final product may possess the requisite mechanical and electrical strength.

Flint occurs in nature as pure silica, which is washed free of impurities and pulverized to prepare for the potter's use. Feldspar occurs as a rock which is carefully sorted at the quarry and pulverized. Ball Clay and China Clay are both aluminum silicates having their origin in feldspar deposits, which have weathered and from which the potash and soda have leached away. China Clay usually occurs in nature mixed with mica and some free silica, which is removed by washing before shipment to the potter. It is weakly plastic. Ball Clay is seldom treated in any way other than to weather in order to thoroughly break it up and permit maximum development of its prime characteristic of plasticity.

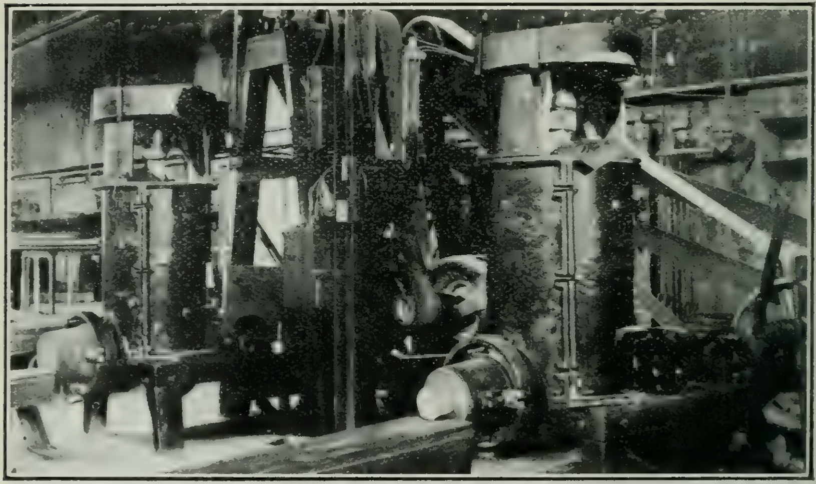
Flint and feldspar occur in nature as rock and require pulverizing before introduction into the mixture. For this purpose grinding cylinders

Grinding Cylinders
(Fig. 31)

as shown in photograph are provided, and in order that no foreign matter may be introduced into the raw material these cylinders are lined with porcelain brick and half filled with flint pebbles. A charge of flint or spar is introduced through the manhole in the side of the cylinder, the proper amount of water added, cover put in place and the whole cylinder rotated till the flint or spar is reduced to the proper state of fineness, after which the cover is removed, and the mixture of water and flint, or spar, run out into the blunger for final mixing with other ingredients.

The liquid flint and feldspar mixture from the grinding cylinders (Fig. 31) is received into a mixer or blunger, to which is also added the requisite amount of ball clay and China clay. These latter materials being by nature very finely divided are merely dissolved or distributed in the flint-feldspar mixture. The resultant liquid of the four ingredients is at nearly the consistency of very thick cream and in potter's language is known as "slip."

"Slip" or liquid clay from the mixing machinery contains more or less foreign material which must be removed by careful sieving in order that the "Body" or porcelain structure may be free of voids which would be caused by the burning or fluxing of foreign materials. For this purpose a shaking sieve is provided having a bronze screen contain-



Pug Mill.
(Fig. 32)

ing in excess of 15,000 holes to the square inch. Two such screens or lawns through which all liquid must pass give absolute assurance of the cleanliness of clay solution.

The mining and shipment of the potter's raw materials entails much handling with the consequent introduction of more or less foreign matter, much of which is entirely harmless, but a certain amount of metallic iron is certain to become mixed with the clay and as such iron is hurtful it is desirable that it all be removed before forming the articles.

Such cleaning of metallic iron is most easily accomplished while the clay is still in liquid state, when it is easily passed by the poles of a powerful electro-magnet which effectively removes all magnetic materials. The photograph shows a magnet which is introduced into the stream of liquid clay so that all parts of the solution pass through a very intense magnetic field. Periodic cleaning of the pole pieces is of course necessary.

Up to this stage the clay is in the state of thick "slip," of cream-

like consistency and a considerable portion of the water must be removed to produce a workable plastic mass capable of being worked into the desired shapes. Photograph shows a part of a filter press, by means of which excess water is removed leaving a so-called leaf of plastic clay ready for working. Liquid clay enters at one extreme of the press, and is forced at considerable pressure into the canvas lined cavities where separation of the water and clay substance take place. When filled the iron plates are separated one by one and the leaf of clay removed after which the plates are again put in position and filtering resumed.

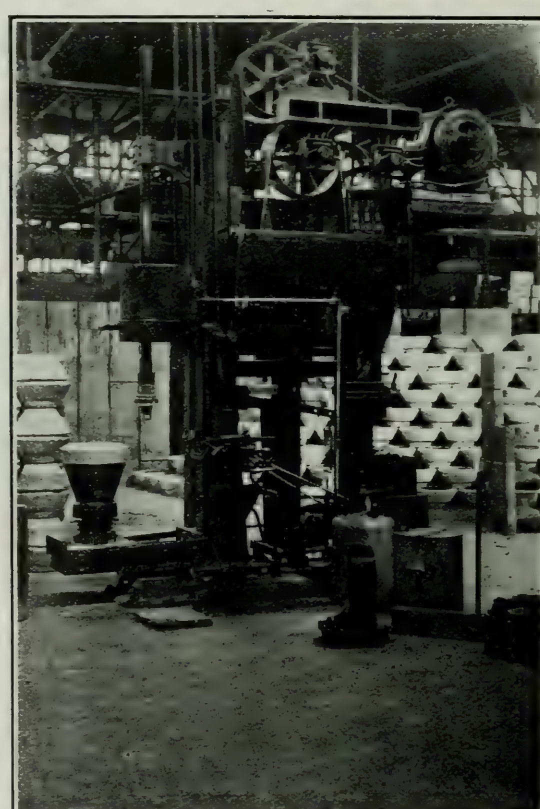
Plastic clay from the presses is seldom sufficiently uniform to permit manufacture of ware. It is necessary therefore, to work out all air pockets and bring the mass to a state of perfect homogeneity in order that the finished product may be free of voids and planes of weakness. This necessary condition is accomplished by passing all clay through a mill as shown in Fig. 32. It is essentially a tube in which revolving cutters on a vertical shaft force the clay powerfully against a horizontal revolving worm or screw, which causes the clay mass to be extruded from the orifice at the bottom homogeneous in state, and of a form to permit ready working to the desired shape.

Art ware is formed of clay largely by hand and is essentially an expression of the individual workman's skill. Clay products of technical service must however, be made with great exactitude, and it is necessary to substitute machine work for hand work. Nearly all electrical procelain, specially high voltage insulators, are made in plaster of paris moulds. Such moulds are cast from exact plaster models. The exterior of the mould is usually framed by a cast iron ring machined accurately so that the finished mould will produce a product surprisingly exact in dimension. It is in the mould the plastic clay is finally shaped, and it is the office of the plaster to absorb water from clay, and stiffen sufficiently to be handled. Moulds are made oversize to compensate for the inevitable shrinkage which occurs in the subsequent drying and burning of the ware.

The Potter's wheel, familiar in all ages, is still an essential tool in many clay working plants, but it is to-day a motor driven affair arranged mechanically to produce rapidly and accurately. The photograph shows a power driven wheel with plaster mould containing clay in place. The mould and its clay are rotated at moderate speed and the accurately made forming tool is pressed slowly into place forcing the clay to assume the exact shape of the forming tool.

When large production is essential or where a screw thread is required the insulator press shown in the photograph is utilized. As in the potter's wheel above described a plaster mould is used to form the exterior of the article, but in this process the interior of the article is formed by a plunger, which is made to rotate in either direction by powerful clutches. At the completion of the downward stroke prompt reversal takes place leaving a mechanically accurate screw thread in the ware where required. This machine is equally serviceable in producing ware without screw threads, since the powerful pressing tends to produce denser and more homogeneous structure in clay wares.

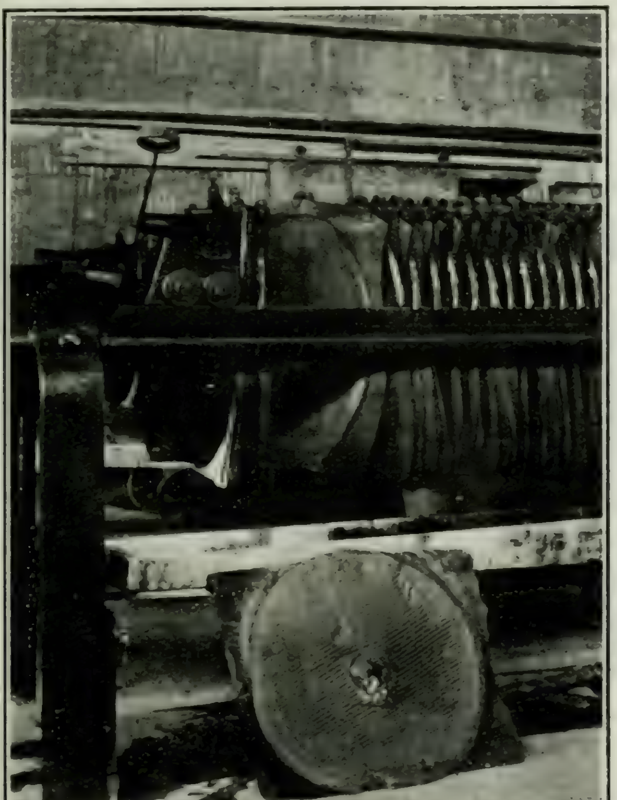
The surface of clay ware made in plaster moulds is seldom perfectly smooth, and it is generally necessary to trim the surface of the clay product to an even surface. This may be done immediately after removal of ware from mould, when in a leathery state, or finishing may be deferred till the article is entirely dry. The machine shown in Fig. 33 is adapted for such finishing work at which time intricate shapes may be carved to suit the purpose for which the piece was designed. In high voltage insulators it is customary to cut side wire grooves and cement grooves during this operation.



Centring Machine.
(Fig. 33)

Clay wares made in the plastic state contain considerable water, which it is necessary to remove before applying glaze, and in the case of heavy pieces required in modern insulators it is essential that this drying proceed properly else internal strains develop resulting in an

electrically weak structure of short life. When dried in the open air heavy pieces are cooled by evaporation from the surface, with the result that drying is held up, and further, the interior is still moist when the outside is comparatively dry, resulting in minute hair cracks in the surface, as well as internal strains. A proper drying system requires the use of high temperature and high relative humidity, in order that the whole mass of clay may become thoroughly heated before any drying may take place. Once the clay mass is entirely heated the relative humidity may be re-

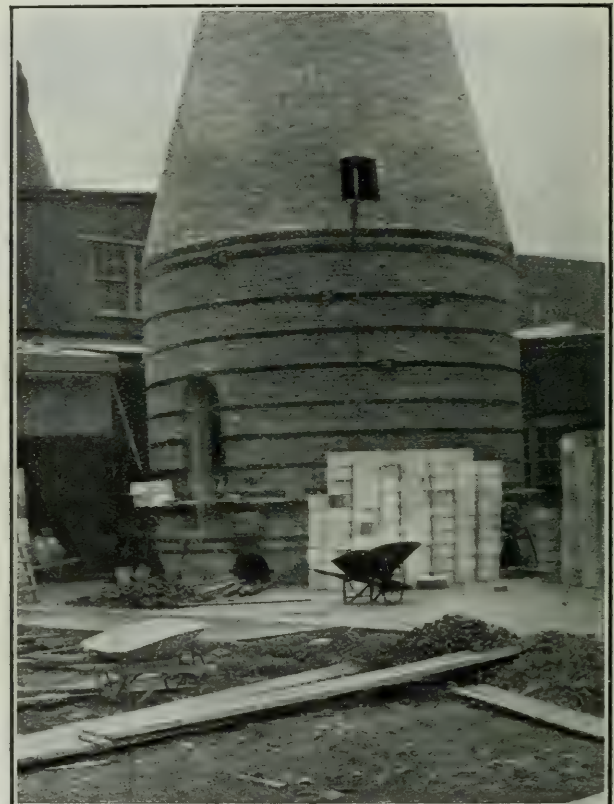


Filter Press.
(Fig. 34)

duced, while the temperature may be increased and drying progresses uniformly throughout the piece without producing strains or cracks.

The photograph shows rooms of brick and concrete wherein temperature and relative humidity are controllable within close limits, thus assuring a product of great uniformity and free of superficial or interior cracks.

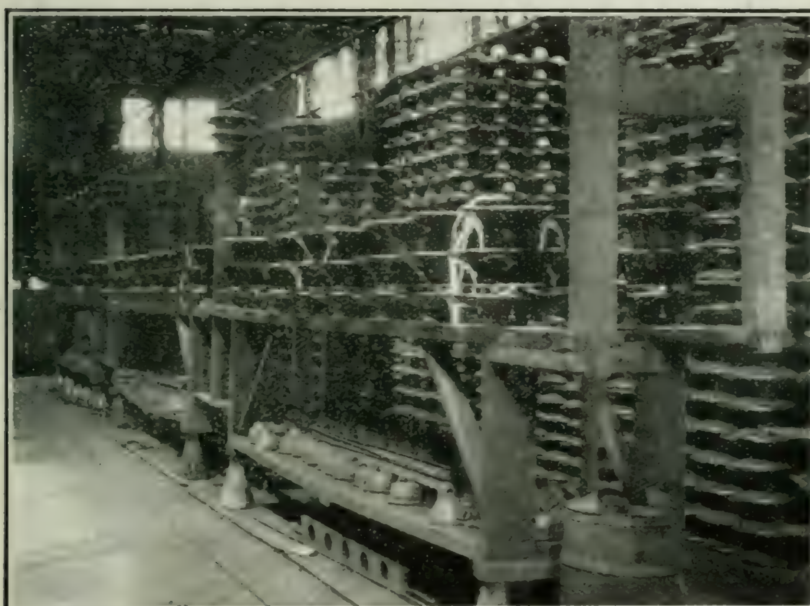
Following complete drying of prepared ware all pieces are carefully inspected and blown clear of dust or other accumulations by a powerful stream of compressed air, in order that the glaze solution in which they are dipped may adhere uniformly. The glaze solution is made up of clay, feldspar and coloring oxides, ground together to extreme fineness. The presence of excess feldspar in the glaze causes it to melt into a thin coat-



Kiln.
(Fig. 35)

ing of glaze when subjected to the high heat of the kiln. No lead or other soluble oxides are used in coating electrical porcelain, since their presence would cause the insulators in the course of time to present a slightly conducting surface. Basically all glazes are alike, the only variation necessary being in the coloring oxide, for white—tin, for brown—iron, for green—chrome, etc.

At kiln temperatures the glaze substance becomes nearly liquid and so spreads itself uniformly over the surface leaving a perfect glass-like finish. Parts in contact with the pots or saggers in which the material is placed for burning, must be left free of glaze to prevent adhesion. Where a complete envelope of glaze is required on the ware it may be supported, if light in weight, on small fire clay points, or if heavy article may be placed in sand which of course adheres to the surface where in contact. Such sand surfaces are sometimes applied for the purpose of presenting a roughened surface to facilitate cementing.



Test Rack.
(Fig. 36)

The pots in which high grade wares are burned are termed "saggers" and are usually made of fire clay, formed on a potter's wheel to the required shape and burned sufficiently hard to develop the requisite strength for the support of heavy clay wares. The photograph shows equipment for crushing and mixing fire clay, as well as a potter's wheel for producing any size or shape of sagger.

The final operation in the production of porcelain is the process of burning, which is accomplished by gradually heating the ware until vitrification takes place, producing a dense, homogeneous product.

The oven in which burning takes place is shown in full view as well as in section. It is essentially a bee hive affair 18 ft. in diameter, by 50 ft. overall height. The interior space of such an oven is packed full of saggers containing the ware to be burned, and a slow fire started in each of the ten fire holes. Fuel may be coal, gas, or oil, all of which are in wide use. At the expiration of 24 hours the entire contents have reached a dull red heat, and as all water has been removed the fires are increased and the temperature raised to 2,500 deg. F. The firing period usully extends 60 hours, and indication of satisfactory finish is registered by electric pyrometers, pyrometric cones and sample discs of ware which are periodically withdrawn and measured to ascertain shrinkage.

After firing has ceased, a period of 48 hours is allowed to elapse before opening the kiln in order that no cooling strains may be introduced in the burned ware.

Fig. 35 shows a kiln being loaded. Also the pyrometric cones and shrink rings in micrometer.

After removal from the kilns the insulators are usually presented to the customer's representative for inspection in order to avoid further factory costs of handling defective ware.

Much depends on the inspector as no specifications have ever yet been devised which can be substituted for the good judgment of an experienced inspector in determining what porcelain should be put on the line, and what should be rejected at the factory.

Porcelain which is just under-fired or just over-fired is in general the most difficult to determine whether it should be accepted or rejected.

Of course such defects as cracks, presence of an occasional foreign piece of matter in the body, warped, defective glazing, crooked assembly, etc.—are all readily detected and rejected.

The porcelain which has been accepted is then trucked to the pans for their first electrical test, where it is subjected to a voltage sufficiently high to break over the piece under such test. By proper proportioning of the piece the flashover voltage is usually 75 to 80 per cent. of its ultimate puncture strength, a safe value determined by many years of trial. The testing circuit is usually at 25 or 60 cycles, and so arranged that a snapping discharge around the porcelain is produced. Such a discharge oscillates at the natural period of the circuit and is found very effective in eliminating any defective porcelains.

The photograph shows a rack of insulators ready for test (Fig. 36). The surface on which they are placed is metal and constitutes one electrode, the hanging chains dipping into the water with which the interior is partially filled form the other electrode, to which a voltage sufficient to flashover the articles is applied.

A 100 K.W. 350,000 volt, 25 cycle testing transformer especially designed for the application of severe tests is used for testing.

The shells which have successfully passed over the racks are then, if of the pin type, cemented, or if of the suspension, capped and pinned.

After which operation they are inspected for cementing and assembly. Then those accepted are placed on the racks for their final flashover.

INSULATOR DESIGN.

The Purpose of a high voltage insulator is to support the conductor in its assigned position and prevent appreciable current flow to earth under all conditions. To accomplish this it must possess primarily great mechanical strength, and be as nearly as possible proof against destruction by weather or other forces. It must also possess electrical strength so that current at normal voltage or even many times normal voltage may not pass through. Passage of current over the surface is unavoidable, but should be kept as low as possible by so arranging the surface that all parts may be kept reasonably clean by the washing action of the rain.

The best possible guide to proper insulator design is a thorough inquiry into the troubles which have developed generally in insulators which have been in service for many years, and these troubles as set forth below have been eliminated by simple and entirely obvious means.

Early insulators were very light in sections, of uncertain porcelain, and rated entirely on laboratory tests. As a consequence they were easily punctured, extremely fragile, absorbent, and because of small size permitted excessive leakage current.

A recognition of the foregoing faults brought about heavier designs of high grade non-absorbent porcelain, rated more moderately and consequently able to perform under all conditions for an indefinite period.

In the past few years additional difficulties have developed which have given rise to much speculation and study. A careful analysis of such troubles as are occasionally brought to the attention of the insulator manufacturers has cleared away all mystery, and it is entirely safe to say that all troubles on modern insulators of high grade hard porcelain may be traced directly to thermal causes.

Hard porcelain of reasonable thickness and of simple shape, not rigidly attached to other porcelain or metal parts is indestructible by weather or continuous high voltage. However, intimate union of porcelain parts by cementing to hardware or other porcelain does introduce difficulties because of the inelastic nature of porcelain.

THE PRESIDENT:—We are very much indebted to Mr. Allen for his interesting paper which he has just given us.

The next thing is moving pictures, and I am informed they will include such subjects as: "The Glow of the Lamp", "Resuscitation," "The Conductor" and "Conquest of the Forest".

(The four above films were shown and proved to be very interesting to the audience.)

SPEECH BY K. B. THORNTON, PRESIDENT OF ELECTRICAL CO-OPERATIVE ASSOCIATION OF PROVINCE OF QUEBEC, AT LUNCHEON JUNE 16th.

Mr. Chairman, Ladies and Gentlemen, I have been asked to say a few words regarding the Electrical Co-Operative Association, Province of Quebec.

About a year ago Mr. Goodwin came to Montreal with Mr. Chase and started the preliminary work which ultimately resulted in the formation of the Co-Operative Association in the Province.

Despite all the meetings, however, which were held, it has been exceedingly difficult to make everyone understand and appreciate the possibilities of this co-operative movement.

In brief the idea is to induce all those of us who are associated, either directly or indirectly with electrical work to concentrate our efforts on developing the business, and our potential resources, by education of the public, and by friendly intercourse and co-operation between ourselves, so as to eliminate the misunderstandings, and wasted effort which have been such a hindrance in the past to the advancement and progress of the industry as a whole.

The Province of Quebec has enormous potential electric power resources which are gradually being developed, and it is our business to see that these resources are made available for the use of the general public.

The Co-Operative movement is an effort to make technical men think and act along commercial lines; you all know that usually technical men talk in a language that is unintelligible to ordinary business men, and sometimes themselves.

What is the use of developing resources if they cannot be utilized when developed? We must educate the public and advise them of the facilities that are available, and that is one of the main reasons for the co-operative movement.

The greatest use that can be made of these resources is in the home.

During the last six years we all know that matters have not been altogether satisfactory in the homes, and there have been all kinds of domestic troubles due to the War; naturally housewives have been turning their attention to find out how they can do things with less domestic help, and as you all know the resources that we can place at their disposal in the way of electrical equipment are enormous, but you will all admit that we have been poorly organized.

One of the greatest troubles has been that even with equipment available, lack of wiring facilities in a house have made these devices unusable; consequently one thing that the Co-Operative Association has planned to do is to educate architects and builders that they should plan houses properly, and fit them up with suitable wiring and outlets, so that householders will have an opportunity to avail themselves of the comforts that have been developed by electrical manufacturers for use in the home.

Recently the Co-Operative Association has published a booklet entitled "The Modern Home," which has been sent out to every builder and architect in the Province; we are also having printed, in French and English a very elaborate booklet entitled "The Comforts and Conveniences of Electricity in the Home"; we expect that thousands of these booklets will be distributed within the next few months.

When these publications are received by the public, it is hoped that they will be of considerable educational value.

I hope that the ladies who are here to-day will encourage their husbands who may be engaged in the manufacture or distribution of electrical appliances and equipment, to become actively interested in the co-operative movement.

Co-operation seems a simple and natural thing to strive for, but it is very hard to secure; what we are endeavouring to do is to develop our energies along the most efficient lines for the development and use of our great natural resources, for the general benefit of us all.

AFTERNOON SESSION, THURSDAY, JUNE 16th.

THE PRESIDENT:—I call the meeting to order. The first item on the programme this afternoon is report from the Accounting Section, to be read by Col. D. R. Street, of the Ottawa Electric Co.

REPORT OF THE ACCOUNTING SECTION 1921 CANADIAN ELECTRIC ASSOCIATION.

Mr. President and Members of the Canadian Electrical Association:—

Your Committee on Acounting in now submitting its Annual Report wishes first to express regret that more active work has not been done. The Chairman, however, insists upon taking full responsibility in this particular, as he had been unavoidably tied up by special work for the first four or five months of the year, which work required his undivided attention. The Committee, however, is of the opinion that as the National Electric Light Accounting Section had entered upon the work of uniform accounting in such a business-like manner, and as the various Committee Activities in each Geographic Division are expected to ultimately conform to the organization of the National Electric Light Association, it was possibly as well to await the outcome of the N.E.L.A. deliberations.

A meeting was held at the Windsor Hotel, Montreal, on Friday, the 20th instant, at which all members were present, and it was unanimously decided to recommend that an Accounting Committee be continued in the Canadian Electrical Association, the scope of this Committee be enlarged to secure the information from member Companies on Customer's Records and Billing Methods, Credits and Collections, Federal Income Tax Procedure, Purchasing and Storeroom Accounting, Costs in their relation to the various Branches of the Accounting Department such as Meter Reading, Billing, Delivering and Mailing of Accounts, etc., etc., and that a uniform Cost Report Form should be decided upon, and that member Companies be requested to supply such report monthly to the Secretary of the Canadian Electrical Association in order that such information, without the names of Companies being shown, might be available to Association Members for purposes of comparison.

In the years 1908 and 1909 a Standard Classification of Construction and Operating Accounts for Electric Light and Power Companies was adopted by the National Electric Light Association. This standard classification was approved by the C.E.A. and its use recommended by the Executive to the member Companies. A few years later the Accounting Section of the American Gas Association went into the matter of unifying the classification of accounts. Shortly afterwards the N.E.L.A. and the A.G.A. Committees met in joint session and reconciled their respective views so far as permitted by the essential differences in the two industries. Later on, Publicity Utility Commissioners of the United States were represented by a Committee

appointed by the President of their National Association. Several meetings were held and attended by representatives of the three Associations. The last meeting of this joint Committee was held at Chicago in August, and a set of gas and electric classifications suitable alike to the needs of Companies, large and small, and in form and detail sufficient for Commission requirements was decided upon, resulting in the publishing of a pamphlet entitled "Uniform System of Accounts for Electrical Corporations prepared by the Committee on Statistics and Accounts of Public Utilities, National Association of Railway and Utilities Commissioners." This means that this system of accounting will be acceptable by practically all the State Utility Commissioners throughout the United States. This system, in regard to electric co-operation, modifies and amplifies the present N.E.L.A. standardization of accounts and, as it is quite possible that similar Commissions may be appointed in this country before many years, it is important that we keep in close touch with these accounting methods.

Your Committee therefore suggests that member Companies keep the above in mind, so that their systems of accounting may tend to conform with the system which will shortly become standard throughout the United States. Your Committee has not sufficiently studied the details of this new Uniform System of Accounts to recommend official approval by our Association. It does, however, recommend that Secretaries and Accountants of Companies obtain a copy of this Booklet which may be purchased from the Law Reporting Company, 17 East 36th Street, New York City, at a cost, we believe, of $1.00, and that the system be carefully thought out with a view of its adoption.

It is further recommended that the incoming Accounting Committee for 1921 shall be prepared next year to give a direct opinion as regards the adoption of this uniform system throughout Canada.

All of which is respectfully submitted.

D. R. STREET, *Chairman.*
H. R. LYONS.
CHAS. JOHNSTONE.
J. BAILEY.
J.J.O'BRIEN.
F. A. JANSEN, *Secretary.*

COL. D. R. STREET:—Before moving its adoption I would like to supplement this report by a few remarks or rather suggestions which might prove of some use to the incoming Accounting Committee.

At the last meeting in Montreal it was felt that frequent meetings, at least quarterly, should be held. It was further felt that the Chairman should take advantage of the privileges accorded, to attend meetings of the N.E.L.A., Accounting Association, as benefit would naturally accrue from "getting together" the exchange of ideas, the expression of individual opinion and the consequent discussion.

In listening to the various papers presented at this meeting many points have struck me as requiring the serious consideration of the Accounting Branch of the various Electric Companies. The speaker at last night's Banquet dwelt particularly upon the difficulties in financing. These who have had flotations of stocks and bonds of late will appreciate that thorough accounting is required under the new methods of financing. The large financial

companies of the present day to whom Public Utility Organizations must appeal have experts in almost every line, experts in physical assets, experts on titles, experts in earnings past and future, all of which mean that statements quickly and accurately supplied by the Accounting Department must be a great factor in the decision of financial institutions as to whether or not they will enter into negotiations for the purchase or sale of stocks and bonds. This alone illustrates the importance at the present time of a uniform system in the classification of both revenue and expenditure.

Another point is a uniform method of making Income Tax Returns, also other returns called for by the Federal and Provincial authorities. The other day in talking with the Income Tax Supervisor at Ottawa I asked him why he did not allow, as the Ontario Government does, certain deduction from net revenue in lieu of depreciation and have the tax remitted on the amount of such estimated depreciation, the reply was, that the Act provided that such deduction from revenue could only be made when an actual amount was set aside for the specific purpose of depreciation.

A further point is, that Accountants must begin to realize the great importance of rendering assistance to Operating Managers. General Managers of Companies of the present day must feel that, with the high cost of operating, their whole time and attention is necessarily taken up and they should not be required to delve into matters of expense. It should be the duty of every Secretary-Treasurer or Accountant to keep the General Manager in touch with increases in the various Branches of expenditure. If this information is readily available every month much money may be saved by quick action.

In conclusion, it is to my mind important that the Accounting Branch of Electric Companies should be conducted in a uniform manner in order that costs may be available for interchange for the purpose of comparison. There should be some system of monthly cost returns for this Branch. As an example, I had a case the other day where it was found that the expense of handling contracts after they had been obtained by the Soliciting Department of the Company, had jumped to 65c per contract. This was a time possibly for about a month or six weeks when contracts were slow coming in and when the staff was too large,—if a close check had been kept the members of that staff could have been employed at other work. The same might apply to billing, to the mailing or delivering of accounts—in fact a follow-up should be had for every district from the meter readings to the time that the completed account is delivered showing delays, if any, and just where such delays occur. If such comparative cost statements were on file with our Secretary for the use of companies it might assist materially in keeping down expense.

I have nothing else in mind Mr. President and now respectfully move the adoption of the report of the Accounting Section.

Seconded by C. R. Reid. (Applause).

THE PRESIDENT:—I am sure we have listened with pleasure to this subject. We thank Col. Street for his report and observations. The report has been moved and seconded, and I now submit it to the meeting, unless some member has a view to the contrary. It is moved and seconded that the report be adopted.

MR. DAVIES:—I wish to express appreciation to Col. Street for bringing in this report. The Accounting Committee last year did not bring in a report. Too many of us feel that the engineering, selling or operating branches are the main divisions of our business, but on the other hand accountancy is a part of our business too and the more of us who became interested in the accounting end, so much the more will it benefit our companies. In most companies 30% of the staff are on acounting work, of one kind or another. Now, the Canadian Electrical Association has got to appeal to every man in the electrical business, whether he is in the accounting end or not. Therefore I want to express a word of appreciation to Col. Street for bringing in the report, so that he may go forward with renewed effort to bring in a larger report next year.

MR. A. A. DION:—As to the advantage of keeping the Manager informed as to the fluctuations in the curve of expenditure, I quite appreciate that, and Col. Street has rendered good service in that respect. The only trouble is the monotony of the curves—they keep going up and never come down.

THE PRESIDENT:—I can assure you that is not a unique position.

Mr. Davies got on his feet just a moment before the time when I proposed to ask him to, because I would ask him to move a vote of thanks to those who favoured us with their reports this morning.

I would ask Mr. Doddridge, if he is here to second it. If not I would ask Mr. Pratt to second it.

MR. DAVIES:—It gives me great pleasure to propose a vote of thanks to those gentlemen who delivered the papers this morning. Words are not necessary, inasmuch as the papers speak for themselves. I am sorry that we did not have more of them.

MR. PRATT:—I have great pleasure in seconding the motion.

THE PRESIDENT:—It has been moved and seconded that our hearty and sincere thanks be extended to all those who contributed to this morning's meeting. (Carried unanimously).

The next item is the report from the "Public Relations Section", by Mr. D. H. McDougall, who I am sorry to say it not here, but the report will be read by Mr. Vinet.

CANADIAN ELECTRICAL ASSOCIATION, 1921, PUBLIC RELATIONS SECTION.

Mr. President ond Members:—

Your secretary has asked me to make a report in connection with the activities of the Public Relations Committee, of which I was appointed Chairman at the beginning of the present association year.

As your representative, I attended meetings of the N.E.L.A. Public Relations Committee, and, by correspondence, kept in touch from time to time with the activities carried on by the National Committee. These activities consisted in the issuing of the Kilo Watt Pamphlets which have been sent to all Class A members, and the co-operation with the National advertising campaign, for which the National Electric Light Association appropriated a very large amount of money, and the manufacturers of electrical apparatus of the United States devoted a large portion of their regular advertising space. The object of this campaign was the education of the reading public

along the lines of enlightenment as to the importance of the electric utility to the community, and the necessity for moral and financial support by all interested in the progress of their respective municipality. The committee also sought publicity through moving picture films, which will be circulated very widely throughout the United States, and will no doubt be available for use in Canada if requisitioned.

Owing to the wide circulation given to the Kilo Watt Pamphlets, and owing to the fact that the Canadian Companies were given the advantages of the publicity work through the circulation of the *Saturday Evening Post* and other magazines in which these advertisements were inserted, due to a wide Canadian patronage of these papers, and acting partly on the advice of the N.E.L.A. officials, it was thought that for the past year it would be advisable to confine our Canadian efforts to the mediums put in motion by the N.E.L.A. To commence a campaign of equivalent effectiveness or dimensions in Canada would have required a considerable amount of money and meetings of representatives from the different provinces, which it would have been very difficult to obtain. In the belief that the best policy was to await developments of the N.E.L.A. campaign, we have not even appointed any additional members to the committee this year. Possibly the new committee which should be appointed for the next year will consider it wise to Canadianize the Kilo Watt Pamphlets by rewriting them, giving Canadian statistics and comparisons rather than United States statistics, as these pamphlets have met with considerable success in the States. In case this is done, it would involve a large expense in printing, and orders for a large number of copies should be first obtained in order to lessen the overhead involved in the setting up cost.

Thanking you for the honour of acting as your representative, and regretting that due to abnormal pressure of business I was unable to attend more executive committee meetings and furnish more detailed reports from time to time to the managing committee.

I remain,

Very truly yours,

D. H. McDOUGALL, *Chairman.*

THE SECRETARY:—I beg to move that this report be adopted.

Seconded by Mr. Barnes.

THE SECRETARY:—May I add a few words? The Public Relations Section is a new one. This Section was organized only last year. I believe that it is going to take more and more importance in the affairs of this Association — of the C. E. A. as well as the N. E. L. A. To show how they intend going after this Public Relations work on a very large scale in the N. E. L. A. I might mention the fact that some of the most prominent men in the United States are members of this Section. It shows that if they have men of that importance and calibre for handling the affairs of this Public Relations Section, they evidently attach a great deal of importance to it. I think we shall have to follow suit right here in Canada, because it is becoming more and more important, as undoubtedly a great deal can be done. During this coming year we shall have to organize the Section very thoroughly, with the hope of obtaining full benefit from it.

THE PRESIDENT:—The motion is carried unanimously.

The next item is report from the Accident Prevention Committee, by Mr. Wills Maclachlan.

REPORT OF ACCIDENT PREVENTION COMMITTEE 1921 CANADIAN ELECTRICAL ASSOCIATION.

It has been the custom of the Accident Prevention Committee to present a detail report, giving the membership, various plans and methods of carrying on the work and also, possibly, some refinements in matters of design or operation. At conventions these have apparently been well received, but have they been put into effect by the Member Companies? Your Committee has reason to believe that they have not. With this information before us the Committee believes that it is not details the membership requires, but rather to acquire the belief that accident prevention and health promotion have a real place in the work of an industry or public utility. Every manager of an industry or public utility will say he does not want his men injured or ill; every workman will say that he does not want to be injured or ill. Do they mean it? Or do they really mean, if it will cost little money or effort? This by no means applies to all companies, nor to all workmen, but is by no means a rare idea.

After graduation from a technical college, a young man served at the front and on his return was married. Due to lack of opportunity to get into engineering work, he took a job as an assistant mechanic. After working for a time, the machine that he was attending met with an accident and he was killed, leaving a wife and a three-months-old baby.

Who was responsible?

1. The engineer who laid out the plans, so that the machine could meet with an accident of this kind.
2. The foreman for not instructing the workman of the danger.
3. The mechanic for not warning his assistant of the immediate danger.
4. The workman for not realizing his dangerous position and taking steps to protect himself.

Who suffers?

1. The Company, by the cost of compensation and disorganization of staff.
2. The man, with his life.
3. The widow and kiddy.

Gentlemen, some of your Committee have gone through the work of investigating fatal accidents, and have seen some of the results that are not shown on the books of any company nor in the details of organization. These results are anything but pleasant to look upon, and as a suggestion to any manager who is not carrying an active organization for the prevention of accidents, we would recommend that he carefully investigate, personally, the next serious or fatal accident which occurs to one of his employees. Let him not look for an excuse for the accident, but get at the fundamental cause and visit, if possible, the dependents. They may be a foreign mother with small children among strangers, whose tongue they do not speak and who do not speak theirs, but the ties of father and husband are just as dear as in those of the most cultured.

Among those Companies that have definite organizations in accident prevention and health promotion there has been a decided lowering in lost time due to these causes, greater production on account of better physical condition, and lower labour turnover due to the desirability of working for

the Company. Detailed facts have been presented before referring to these matters and can be produced. Your Committee, however, would warn against an excited campaign with no definite permanent organization. Unless the organization can be as definitely part of the whole plant as that of the treasurer, then no good results can be expected.

It is possible to build a power plant without any pre-arranged designs or definite organization, and it is possible to carry on the commercial side of an organization without a definite plan, and it is not necessary to advise this Association of the results that will be obtained. Similarly, it is possible to carry on a so-called accident prevention campaign or one dealing with the matter of the health of the staff wtihout a definite organization and plan, but the results will be anything but those desired. Companies apparently realize that accidents interfere with the successful carrying on of their work, and realize that if their staff is in poor health the best results cannot be obtained. What they do not seem to understand is, that by applying to these problems the expert knowledge that is available, they can reduce accidents and improve the health of the staff. From information available to your Committee they know that this work is carried on successfully from a purely economical and financial standpoint, and they also know that where these activities have been carried on there has been an improved relations between staff and management, and increased efficiency in the operation of the utility.

We wish to draw your attention to the Report of the Accident Preventive Committee of the National Electric Light Association, which gives a number of details for those who are interested in the subject. We would also direct your attention to a series of articles appearing in the N.E.L.A. Bulletin from January to June, 1921, dealing with the subject, and prepared by experts in the various spheres.

We do not wish it to be understood that your Committee has not carried on its regular work during the year, but wisn to impress upon the membership that before accident prevention and health promotion can be said to be a real factor in public utility operation in Canada, there will have to be more interest shown, both on the part of management and men in the large and small companies than there is at the present time.

Before closing this report mention should be made of the medal which the Association offers to anyone throughout the Dominion who resuscitates any other person from electrical shock by the Prone Pressure Method. The medal, besides being an insignia of which anyone could be proud, will also have an historical bearing in-so-far as the metal of which it is to be made will have been used for a feat of some kind in the development of the electrical industry. For instance, the first lot of medals will be struck by using copper which was in service on the first high-tension transmission line in the British Empire some thirty years ago. When that first lot is exhausted, some other metal of equally significant meaning will be used, and so on.

The purpose of this medal is to stimulate a greater interest in the thorough practice and drilling of the Prone Pressure Method of Resuscitation from electrical shock, which, besides its humanitarian aspect, will also tend to diminish the number of unfortunate casualties which, most of which cases, ought not to happen at all.

Respectfully submitted this sixteenth day of June, 1921.

WILLS MACLACHLAN, *Chairman*.
A. P. DODDRIDGE.
V. LAURSEN.
L. A. KENYON.
J. T. LAMBERT.
J. H. MARTIN.
E. PUXTON.
E. VINET.
J. S. H. WURTELE.
JOHN L. COLLINS.

MR. MACLACHLAN:—I move that the report be adopted.

We have here the design that we have finally decided, or which is almost decided upon, for the medal. On the face of the medal will be a man performing the resuscitation, and on the back some of the details of the presentation.

I have here three or four copies of the Accident Prevention Committee report of the N.E.L.A., of which I have the honour to be the Secretary for the last two and a half years. There are one or two points in that that I would like to draw to your attention particularly. Yesterday I mentioned the case of electrical explosions, and some complete details are given here in connection with the recommendations in regard to such operation. There is also a very detailed report on the question of fire prevention, and one or two other matters of interest.

I thank you.

THE PRESIDENT:—Will some gentleman second that?

Seconded by C. R. Reid.

THE PRESIDENT:—Gentlemen, it has been moved and seconded, and in a moment I shall put the motion to the meeting.

I feel you will all agree that it is of the greatest possible satisfaction to the Association that we have someone who interests himself in this matter as Mr. Maclachlan does. I am pleased to say in regard to the medal, that that spirit which is really never absent from any thinking body of men, the spirit of sentiment seems to be wrapped up in this suggestion, and in advance I congratulate my successor in office who may have the pleasure of presenting the first medal won under this arrangement. It gives me considerable pleasure to record our appreciation of Mr. Maclachlan's services.

THE SECRETARY:—If I may be allowed, I would like to make a few remarks in regard to the Accident Prevention Committee Report. I happened to be on this Committee, and I think that quite a few of our Company members can do a great deal in the matter of accident prevention. It may be of interest to mention my own personal experience on this subject. It is only a couple of years ago, after I returned from the Front, that I actually became connected with this subject, and at first I did not take it quite as seriously as I do now. I saw then that all our people in our various companies (I am speaking of the Shawinigan Company) should become thoroughly acquainted with the prone pressure method of resuscitation. I may say that as the months passed by and the more I did in this connection, the more I became interested in the work, and I believe that we have done a great deal in that way to foster very good relations and good feelings between the two ends of the Company. It is a wonderful way to get close to the men, because you get

near them through this question of looking after their welfare. I think I can rightly say that the results have been very apparent in our own Companies. We have not lost anybody through electric shock since we commenced training our people 15 minutes each month in this method. We have resuscitated so far four, who were shocked with various voltages, from 4500 to 100,000 volts. It took from 3 to 20 minutes to resuscitate them. There is not the slightest doubt in my mind that they were actually resuscitated and could not be alive today if they had not been resuscitated.

The object of the medal which is being offered, is to stimulate greater interest in this work, and I think the Chairman of the Accident Prevention Committee will agree with me, that this should be very general throughout the country not only with the men dealing directly with electricity, but also should be given in the schools. We ought to educate the children. Time does not allow one to go into details, but it is extraordinary how some benefits have been obtained through children learning it in school.

It is to be hoped that throughout the Association, and in fact everywhere in Canada, this will develop to a greater extent than it has in the past. As a matter of fact every accident that takes place reflects upon the dangers of electricity and there is really no reason why we should lose people through electric shock, except in very few cases. Personally, being a member of the Accident Prevention Committee, I sincerely hope advantage will be taken of the offer, and that we shall have to give a good many more medals than we anticipated; and while, of course, it would be better to have no accidents at all, yet we must be able to anticipate those that do occur. It will be hoped that every electrical accident will mean a successful case of resuscitation.

MR. MACLACHLAN:—Mr. President, just a minute. One thing I would like to point out to those present, from Quebec or Ontario. In 1915, under the Workmen's Compensation Act, when a man was injured he received 55% of his wages, no medical attention, and if he was killed his widow would receive $20 per month. Our rate then, without carrying on accident prevention work, was 2½% of the pay roll. Today the position is: 66 2/3 per cent. of the salary, full medical attention (first aid, full hospital and surgical attention, operations, etc.), payment has been increased from $20 to the widow to $40. By carrying on accident prevention, our rate is 1%. This work is carried on by the Electrical Employers' Association. (Applause).

MR. ANDERSON:—Might I ask Mr. Maclachlan if the attention of the technical schools has been brought to accident prevention. I have in mind an unfortunate accident which happened in Toronto, of a near graduate of the school getting himself tied up in wires, killed, and was not able to be resuscitated by anyone.

MR. MACLACHLAN:—This has not been given nearly enough attention in the schools. I offered to teach students both in the schools and universities the resuscitation method. It is a case of getting after the children, and that is what we have the moving pictures for.

MR. DAVIES:—How long is the $40 payable to the widow?

MR. MACLACHLAN:—Until she re-marries. At that time she is given a dowry of two yearly payments. If she does not re-marry, it is paid until her death.

(Here Mr. Milan R. Bump entered the room.)

THE PRESIDENT:—We now have in the room an honoured guest of the Association—the recently elected President of the N.E.L.A., Mr. Bump. Mr. Bump has been kind enough to intimate that it is agreeable to him to address some remarks to the Association. I am sure it will give us great pleasure to defer further motions until we hear from him.

ADDRESS OF MILAN R. BUMP, PRESIDENT OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

In the first place I want to apologize for not having been here at the time it was planned I should, but I was unfortunately detained in New York.

I always feel at a time like this that the practical training of an engineer in dealing with facts in a matter of fact way is lacking in some of the essentials, among which is the ability to say things and to appear before people and make the impression that one would like to make. If we could have all of us had the legal training of your President, Mr. Grier and could have achieved his reputation—he is known in the N.E.L.A. as the "silver-tongued orator of the St. Lawrence"—we could carry our message much more clearly and make a better impression with it.

In coming up to the Canadian Association, I want to say I feel exactly the same as if I were going from New York to one of the geographical conventions in any district of the United States. I feel that the tie that binds the electrical industry is so close that international boundary lines are wiped out. I feel that through the ties of an industry such as ours there is more hope of international understanding and international co-operation than there is through State and Government negotiated treaties. I feel that through industrial understanding and co-operation we are bound to work out the problems of international relationship to a greater extent than in any other way.

The N.E.L.A. has started on a campaign to really tell the world what a wonderful industry the electrical industry is. It has started out to tell others what the members of the Association themselves have known for many years. The conditions at the present time in most industries in the United States at least are very backward and the worst that have been experienced for a number of years, fortunately the electrical industry is not in that condition, and as a whole will have a good, if not a record year. The industry is benefitting from the lower prices of material and labor, and in a certain sense is thereby benefitting from the discomfiture of other industries, but the fact that any industry can stand at a time like this and maintain a satisfactory showing of net earnings, such as our industry is showing, is a tremendous factor in its favor.

We who have known the industry have always claimed that electrical utility securities are entitled to a very high rating. They are next to Government and State securities the best form of corporate security and have every right to claim the standing we have claimed. We know the industry has a growth and future before it that absolutely precludes the possibility of its standing still. I do not think that any of you have ever heard of a case of a central station company having idle capacity for any length of time.

When you consider other industries and the securities based on them and realize that there are years that go by when forty and fifty percent and even more of the capacity installed is idle, it is wonderful to be able to say that in our industry there is no such thing as idle capacity. Temporarily, certain classes of load may drop off, but other classes always come on, and the normal growth soon catches up to any decrease due to the dropping off of one industry or another.

The N.E.L.A. is carrying on what is known as a National Good-Will Campaign. It is not confined by any means to the limits of the United States. The thought behind it is this—that if we connected with the industry and knowing what it is believe in our hearts that it is the wonderful industry we talk to ourselves about—if we have the sincerity of our own convictions, the only obstacle in the way of having the world realize the wonders of our industry is our failure in the past to properly tell our story and to educate the world to what the electrical industry really is. The facts in the past that have tied down the electrical industry and other public utility industries to some extent were excusable no doubt. There was a lack of appreciation of the fact that the public had a full partnership in every utility and had as full an interest in the success as the stockholders and bondholders. For the past fifteen years this feeling has been growing and we have now reached a point in the United States where the bulk of the new money that is going into the utility industry is coming as a result of the education of the public and not as a matter of routine banking in the old-fashioned sense. The greater part of the new money utilities are receiving today is coming through customers ownership campaigns, campaigns based on the education of the public served, selling to the public preferred securities of the property in the community where service is given. The results of the campaigns are remarkable. Some large companies are getting practically every dollar that is essential to their present growth through these campaigns. These activities are not conducted in centers where the people are educated to the purchasing of corporate securities, but the greatest success is often attained where the population is largely foreign and composed of a class of people who have never been security investors in the past. A notable example, mentioned at the National Convention, was Oklahoma City, the State Capital of Oklahoma, surrounded by rich agricultural country, the principal form of security heretofore sold being small independent oil development propositions. The public utility company in that city started a campaign three years ago and in that time have sold securities to such an extent that they now have over 1,800 security holders in that city and practically every dollar necessary for the growth of that company has come from the sale of these local securities. The same condition prevails in the farming sections of Minnesota and on the Pacific Coast, where the California companies are raising millions of dollars to continue the promotion of their water power developments.

The basis of these campaigns is the education of the public to a realization that the problem is a mutual one and it is to this educational campaign that the National Association is directing a very large part of its efforts and attention. It is more or less a missionary work. The benefits following such a campaign are too great to estimate, even aside from the financial support gained. The strongest factor in favor of any company is a large body of citizens who own securities of the company and who know through their ownership what the facts are governing the service in their territory. The

towns that have followed this plan have found that the local security holders are intensely interested in the securing of proper rates, the removal of un-earable franchise conditions, etc. In some cases the stockholders have even gone so far as to call attention to the efficiency of company employees, by watching them at their work. They also report properties in dangerous condition and have been the means of averting many accidents.

In the remodelling of the constitution of the National Association two years ago, the underlying principle was to provide for geographic sectional organizations. It was realized that a form of organization was needed under which each section of the territory covered is automatically represented on all important committees by its sectional representative. It was felt that this would insure a member from every section who could present the views of his section on every subject before the Association. The plan has one weakness which must be guarded against. If each section does not see that it has a representative through its own appointment on the committee or if it does not insist that these representatives are active in presenting their views before the national committees, the section is liable to suffer through inaction. The National Committees urge and desire active committee representation from every geographic section at all times and are doing everything possible toward that end. If I have one plea that I would make to you to-day it is this—tie yourself as closely to the active machinery of the Association as you can, having a man appointed as your committee representative who can give as much time and attention to the work of each committee as possible. It is true that it is impossible for men living at a great distance to attend committee meetings regularly, but that does not prevent them from presenting the viewpoint of the section they represent to the chairman of the committee so that no action will be taken against the judgment of that section without giving every opportunity to be heard. The National Association is trying its best to work intimately with the geographic sections. We are trying to carry our message not so much through the National Association activities or through the central organization as to make the National Association a clearing house to receive, classify and disseminate information and pass it to the various sections of the Association so that it may reach the membership more efficiently than it could through central organization. It is our hope that each section will become in effect the N.E.L.A. within the territory it represents and that a great deal of the presentation of reports, etc., that have heretofore been carried on through the Association at its convention will in the future be conducted through the sectional meetings and that the discussions and questions asked at the sectional meetings will be assembled so that the final disposition of any report will represent the true feeling of the entire membership and not be confined to the brief attention which the subject may receive at a National Convention.

One of our activities during the coming year relates closely to the Canadian situation. Out on the Pacific Coast and in the Northwestern States certain political activities have recently sprung up under which there is a desire for Federal and State action in developing primarily those water powers incident to irrigation development and the distribution of that power to residents of the territory under this development. The Ontario Power project is looked upon as a model to be copied and we expect to appoint a committee to make a full, complete and fair investigation of the Ontario project so that we can supply our Western member companies with the exact facts regarding this project up to date.

The world war forced our industry to face problems that had previously been thought impossible, yet all of us found ways to solve them and have learned a great many lessons as the result. One of the greatest lessons learned as far as the United States is concerned is this—before the war regulatory bodies generally considered their prime duty was to lower rates. When the absolute necessity of the utilities arising from war conditions was placed before them, the commissions realized that they had just as much of a duty to protect the investment as to protect the public against unfair rates. The results of the war period have been that in the future the matter of rate adjustments will be a simpler and easier problem than it could possibly have been otherwise. There is now a general realization by the public that there is a proper balance between net return and rates which will permit reasonable and proper growth of utility service, attract new capital and at the same time not impose an unfair burden upon the public.

As I have said, we are trying through the Good-Will Campaign to reach the entire public in an effective way. The manufacturers have donated a vast amount of space in technical journals, popular magazines and newspapers and the utility companies are in many cases copying articles that have appeared in magazines such as an editorial in Collier's and we believe that the reading public has been very effectively reached. It was felt, however, that another large class of the public, which attends moving picture theatres but does not read general magazines, should be reached and in order to reach this class we have developed as a demonstration the first movie, which can be supplied to any moving picture house as a filler. Most moving picture houses are glad to have these fillers if the subject is of general interest.

Our first attempt was worked out in a general way to show the origin of electricity in the home and in this we purposely avoided bringing in industrial or business subjects, as these can be reached later. The first picture tells of Thor, the god of Lightning, sending his messenger, Kilowatt, to remove Drudgery from the home. Kilowatt goes through the house and at each point that he finds heavy manual labor, he replaces this labor with the proper electrical device to lighten the work, such as washing machine, electric range, vacuum cleaner, wiring, etc. Following this in a very few feet of film is a brief view of the electric power plant operations, both steam and water power, and the whole subject is held together by a character appearing as a grandfather telling his grandson the story of electricity. At the end the grandfather is seen going into the public utility office to make his last payment on securities of the local company.

The film was shown for the first time at the Chicago Convention and I feel, impressed everyone who saw it very deeply. It is planned to make copies of this film available for sale or lease to utility companies and to conduct a campaign to have it shown in every movie house in the country. It is called "Back of the Button" and shows prominently on its face that it was produced under the direction of the N.E.L.A. Many big movie houses have already applied to use it as a filler.

One of the important features of our work is our Engineering and Technical Section. It has sometimes been felt that there is an overlapping between this Section and the work of the engineering societies. It has not been the desire of the N.E.L.A. to either interfere with the work of the societies, nor to cover the technical field which they cover. On the other hand, there is an enormous field, which might be called "engineering practice and application" which the other societies do not go into and which our Association feels must

be carried on for the good of the industry. We have for example the problem of inductive interference, which has become a constantly bigger problem in recent years. As far as the technical engineering side of the problem is concerned, engineers feel that this part is pretty well solved, but when it comes to practice and to the proper division of expenses for applying curative means to prevent the trouble, this field has not been touched and it is just such a field that the engineers connected with the Association are attempting to cover. I feel you will realize that in this one field alone there is a tremendous amount of work to be done and a work that is vital to the life of many power companies serving thickly populated centers. The telephone industry is practically under one organization, The American Telephone and Telegraph Company, and they have their engineers working consistently as one organization. They have had this great advantage over power companies, where each company was an individual in a local territory. The telephone interests have maintained a staff of experts on this work and have seen to it that the entire telephone industry stood together as to the principles involved. During the past year the Public Policy Committee, under the able direction of Mr. S. Z. Mitchell, appointed a sub-committee which met with a committee of Vice-Presidents of the American Telephone and Telegraph Company and formed themselves into a board or committee to work out the practical side of this problem. Mr. R. L. Pack, formerly of Toronto now of Minneapolis, is the principal operating representative of our Association in conducting these negotiations. As soon as the engineering report is completed, the executives will meet to decide upon the proper solution of the problems involved.

As far as the United States is concerned, we cannot see that any of us have anywhere near reached a point of saturation in the growth of the electrical business. In fact we are so far behind in most communities that we are still in the position of just starting to realize our possibilities. Less than half of the homes in the United States are wired; less than half of our wheels are turned by electricity; practically none of our trains, with the exception of one road in Montana, Idaho and Washington, are as yet moved any great distance by electricity. Before us lies the problem of seeing that every wheel that can be turned by electricity, every transportation wheel that turns is moved by electricity and every labor saving act in the home that can be performed by electricity is served by electricity and just as fast as our economic situation can be worked out our field will develop and expand. It is a wonderful movement. It is a movement almost akin to missionary work. Those of us who feel we realize the possibilities of the future of the electrical industry cannot but be impressed with the work we are doing and realize that we are doing something to make the world better and brighter. If we can carry this work along, I am sure we will all have the satisfaction of feeling that regardless of personal success we are engaged in a work that means something for the best good of the world and that the knowledge of a task well done will be its own recompense. The knowledge that we have done and are doing more to make the world better than any other industry and that we still have bigger fields to conquer is sufficient knowledge to justify our faith in saying that the electrical industry is the best industry for any man, woman or child to be working in, investing in or using service from. (Great applause).

THE PRESIDENT:—Gentlemen, I shall not risk the reputation I am honored with in the N.E.L.A., alluded to by the speaker just now, by attempting to say anything elaborate. But obviously nothing of that sort is in the least degree necessary, because Mr. Bump has commended himself to us by his own message. I can assure him that the feeling which he has of coming into a friendly territory, coming from the U. S. to the branch of the electrical industry here, is reciprocated by us to him, and in him we recognize the advent of a friend. We appreciate the timely words we have just listened to, and I therefore ask you to show your feelings by rising and applauding, and so convey our thanks to Mr. Bump for his kind words. (Applause).

MR. BUMP:—Thank you.

THE PRESIDENT:—Gentlemen, as our next appointment is shortly to be held, I think we will proceed with these papers rapidly, and I therefore put it to the meeting that we adopt the report from the Accident Prevention Committee. All those in favor (Unanimous decision). I declare the motion carried.

Next report from the Membership Committee. Mr. Pike not being here, Mr. Vinet will read it.

CANADIAN ELECTRICAL ASSOCIATION, STATEMENT OF MEMBERSHIP,—JUNE 16th, 1921.

	Total Membership June 1921.
Class "A"	42
" "B"	163
" "C"	19
" "D"	14
" "E"	15
" "F"	12
" "G"	48
Total	313

SECRETARY:—Read report. Then said:

I believe that this year it will be the duty of the membership Committee to make special effort to increase Class A and D membership, as by increasing these two Classes we shall naturally expect to increase very decidedly Class B and also Class E membership.

I beg to move the adoption of this report.

Seconded by Mr. Doddridge.

THE PRESIDENT:—Carried unanimously.

In case otherwise I might forget it, I have to announce that we have received a kind and generous invitation from the Honourary Secretary of the Quebec Golf Club:

"Chairman, Entertainment Committee:

"I am directed by the President and members of the Quebec Golf Club "to extend to visiting members of your Association the privileges of the "Club during their sojourn in Quebec."

On behalf of the Association I thank the Golf Club for its kindness.

The Canada Steamship Company advises that if ten or more members desire to take in the Saguenay trip, it can be done at a reduced rate.

Next paper, "Report from representative on Canadian Engineering Standards Association"—"Pole Specifications," by Mr. O. V. Anderson—"Electrical Appliances and Supplies", by Mr. E. C. McGovern, Northern Electric Co.,—"Transformers", by Mr. A. A. Dion, Ottawa Electric Co. I now call upon Mr. Anderson.

REPORT—REPRESENTATIVE C. E. S. A. SUB-COMMITTEE POLE SPECIFICATIONS.

This Sub-Committee was appointed for the following purpose:—

1. Consider feasibility of drawing up Canadian specifications for the purchase of wooden poles used in the various classes of the Electrical transmission lines.

2. To investigate the present use in Canada of preservative treatments, and if advisable to draw up specifications for preservative treatment, such, that the general use of which could aid in the conservation of an important part of our timber resourses.

3. To keep in touch with the various investigations now being carried out by the various organizations in the United States.

It has been considered that the work of this sub-committee could at least for the present be carried out by correspondence.

There has been prepared for the benefit of the members of the committee a parallel analysis of the,

1918 Western Red Cedar Association.
1917 Northern White Cedar Association.
N. E. L. A. Northern White Cedar.
N. E. L. A. Western Red Cedar.
1912 Eastern White Cedar Association, Railway Signal Association.
1920 American Railway Engineering Association.

In February 1921 a questionaire was sent out. No report has yet been received as to the information obtained in reply to the questionaire.

This year's Overhead Systems report gives an exhaustive report on the revision of wood pole specifications and preservative treatment of poles. This has been previously referred to in the Overhead Systems Report.

After the member companies have been able to review this report, they will perhaps be better able to say just how their wishes can be best met.

The questionaire sent out by the Overhead Systems Committee asked for data on the pole situation, the replies to which indicated the desirability of pole specification revision.

In looking over the membership of the committee, I find that there are three of the members of the Overhead Systems Committee on it, so that the pole specification will undoubtly form a big portion of next years work.

Respectfully submitted.

O. V. ANDERSON.

MR. ANDERSON:—Read report. Then said:

It is customary for the Chairman of the Committee to suggest subject which the succeeding committee should take up. I think there is no other subject they can go into with any better effect for the Association than to take the very valuable report presented by the N.E.L.A. Committee, which is very complete, and carries out an analysis of our conditions, and think they could take that up as their work for next year. Mr. President I have pleasure in moving adoption of this report.

THE PRESIDENT:—If agreeable to all, we will have them all seconded when we have had the three reports of this section completed. I now call on Mr. McGovern.

REPORT OF THE SUB-COMMITTEE ON CANADIAN ELECTRICAL CODE FOR APPLIANCES AND WIRING OF THE CANADIAN ENGINEERING STANDARDS ASSOCIATION.

As your representative on the above Sub-Committee, I feel rather disappointed in not being able to report any material progress in the work this body proposes to do.

Briefly, the scope of the work to be undertaken by this Sub-committee was referred to in a report of the Electrical Sectional Committee of the Canadian Engineering Association at their third ordinary meeting held in Ottawa on April 4th, in which it was proposed that the Sub-committee would arrange for "the preparation of specifications relating to the proper construction, methods of testing and approval of appliances, fittings and materials used in connection with interior electrical installations, such specifications to be framed with full regard to the opinions of the various provincial and other bodies having jurisdiction, and to be based as far as possible on documents of this kind having wide acceptance."

From our own experience we can all appreciate the desirability of establishing a code of standards regulating electrical appliances and the wiring incidental thereto. The numerous different appliances and attachments on the market, together with varying provincial requirements regulating their use suggest a problem which is of vital interest to the whole industry, and particularly to the appliance and supply manufacturers.

It is apparent that this Sub-committee must be a widely representative one. It is only in the process of formation, and although a chairman has not yet been appointed, some progress has been made in the organization, and nominations have been received for the personnel.

Inasmuch as our committee has never met, it would be quite out of place for me to discuss at length the merits of the question. I feel, however, that the subject is entitled to your very earnest consideration, as our Association will be called upon very shortly, I hope, to consider a proposed code of standards, regulating a very large category of appliances and fittings.

Respectfully submitted,

E. C. McGOVERN.

MR. MCGOVERN:—Mr. Chairman, I respectfully propose that this report be adopted.

THE PRESIDENT:—I would now call on Mr. Dion to read his report on transformers.

REPORT OF SUB-COMMITTEE ON TRANSFORMERS C. E. S. A.

MR. DION:—Mr. Chairman, I have no written report. There is not very much to say. I will write one for the records later if you desire. Shortly after the formation of the Canadian Engineering Standards Association, I

was asked to form part of the Electrical Section. As you probably know, the Canadian Standards Association is a volunteer body which is approved of by the Dominion Government, which gives it a grant of money and office room, and assisting in its work in that way. We have a permanent Secretary; there are several sections and a Main Committee. Later on I was made a member of the Main Committee. The question of Transformers was taken up soon after the formation of the Association, at the request of some Companies. They wanted to lessen confusion in installation, to lessen the number of sizes so as to reduce cost, and to standardize such characteristics as could properly be standardized so that there would be no confusion in their use by men of little technical knowledge. The Technical Committee was selected so as to include all interested parties—users, manufacturers and dealers—and all sections of the country as far as possible. I was made Chairman of that Special Committee, and there was besides another representative of this Association on it. The Committee first sent a questionnaire to find out if there was a general desire for this standardization; then when it was ascertained that there was a general desire, a second questionnaire was sent out, asking what should be standardized and a general expression of opinion. This was followed by a meeting in Toronto, and a whole day was spent in discussion. A temporary code was drawn up covering certain points. This was sent out for criticism so that members, after going about and thinking the matter over, could further advise. Another meeting was held, which took another whole day, and finally a report was sent to the Electrical Section—adopted—then to the Main Committee, which also adopted it, when report was published, standardizing certain points in transformer construction. This report is available. While the Association has no means of endorsing its regulations, it is to be hoped and expected that the manufacturers will comply with them, so that we will get standardization to a very considerable extent on service transformers to the benefit of users. The Main Committee was later asked to take up the question of station transformers. This was referred to the same Special Committee. While we realized that it was a much more difficult problem than that of service transformers, we sent out a questionnaire to ascertain if there was a desire for this standardization, and while there were opinions expressed on both sides, the majority were in favor. The questionnaires have been sent, preparatory to a meeting. The matter rests there. Shortly there will be a meeting of this Committee when the matter of station transformrs will be discussed.

I move the adoption of this report.

THE PRESIDENT:—As all three reports are impressed under the one heading, I think it would be quite in order to have just one seconding. Will some gentleman second?

MR. McDONNOUGH:—I second the motion.

THE PRESIDENT:—It has been moved and seconded that this report be adopted. Carried.

Messrs. Barnes and Reid will read report on the "Activities of Toronto Section and St. Maurice Valley Section."

MR. CHAS. T. BARNES:—I wish to convey to you, Mr. President, the personal regards of Mr. McDougall, who is not able to be with us after so many years of being present at these conventions.

THE TORONTO SECTION OF THE CANADIAN ELECTRICAL ASSOCIATION.

The Toronto Section have just concluded a very active and successful season. The membership at the present time consist of 36 Class B members and 29 members of the Ladies Auxiliary making a total Section membership of 65.

The Annual meeting was held on September 30th 1920 when officers for the season were elected and at this meeting it was decided to inaugurate a Question Box in order that employees might have the benefit of older members' experiences. Boxes were installed at the office and at the Power Station.

These proved to be of great value. Many and varied were the questions asked by all departments, answers were given at our regular monthly meetings and were illustrated by blackboard diagrams when necessary by the respective heads of the different departments to which the questions were applicable.

We held eight Social Meetings during the season and the usual procedure was to open the meeting at 8.00 p.m. with answers to questions. This usually occupied about one to one and a half hours, after this the room was cleared and an orchestra played for those desiring to dance while those not dancing were assigned to another room to play progressive euchre for which small prizes were donated to the winning couple.

The Ladies Auxiliary served light refreshments about 11.00 p.m. and the proceedings closed at 12.00 sharp.

Our December meeting was known as our "Cartoon Night" and the Programme Committee presented by the aid of a Lantern several slides depicting some of our members activities treated humorously.

February 23rd we had a Masquerade Dance which was highly enjoyed.

March 23rd the members put on a Minstrel Show. At our last meeting May 5th the Ladies Auxiliary presented a Play entitled "The Young Village Doctor" in which the cast was entirely composed of Section Members.

The average attendance at these meetings which were for members and their friends was 90 by invitation.

It will be seen from the above that the social relations of the employees to each other and the Company were specially cultivated, the results show that the "Esprit de Corps" has improved remarkably and a spirit of friendliness exists which we believe would be impossible without such an organization and which is largely due to the deep interest taken by the Ladies Auxiliary. The Management are very generous in their treatment of our Section, financing the entire cost of the Social Evening and showing a sympathetic interest in our activities.

In view of the change which has taken place in the ownership of the Company we are connected with there is an uncertainty about our next winters activities but we are all hoping to be able to continue our Section and carry on to a greater degree than in the past.

Chas. T. Barnes,
Sect. Treas. Toronto Section.

ST. MAURICE VALLEY SECTION, OF THE C. E. A.

Mr. C. R. Reid, Chairman

Mr. Chairman, the St. Maurice Valley Section was organized at the beginning of the year, largely due to the initiative of Mr. Vinet, the Secretary of your Association. We took considerable time in discussing the matter before

we started in, to be sure of success. At first there was some talk of organizing an independent engineering society, but some of us were able to show the advantage of being affiliated with the Canadian Electrical Association, and we were organized on that basis. Our organization consists of a Chairman and Executive Committee, which carries on the routine business of the Section, together with three committees, one on programme, one on education and the third on membership. Our activities are under the control of these committees, the most important, of course, being the programme committee, and our meetings are arranged by this committee. We have had eight meetings so far this year with an average attendance of 50. At present our plans call for a meeting every three weeks, two meetings in Shawinigan Falls and a third in Three Rivers. Later on, as we get members from the other towns in the St. Maurice Valley, we plan to hold occasional meetings in those places, when we have subjects which we think will be of special importance to the members living there.

In order to arrive at a practical working basis, at one of our early meetings we called on the members present to suggest topics which they thought we could discuss with profit, or which the individual thought he would like to hear discussed. We got a very prolific response from these requests, and some 20 or 30 subjects were tabulated and made use of by the programme committee in selecting topics for later meetings. Some of these topics were as follows:

Meeting on radio communication, with illustrative apparatus.

Meeting on electric drive for paper machines, held at Three Rivers, largely attended, at which we had representatives from the different manufacturing companies building such electric drives.

Later we had a meeting giving sketch of the developments of the Shawinigan Company, together with slides. Mr. Kaelin, Chief Engineer of the Company, very kindly gave us this sketch.

We have also had several other meetings, our last meeting being on the subject of electric furnace operation, and was very largely attended. Our plans call for no meetings during the summer months. Our programme has already been made up for this fall, and we expect to continue as we have begun, learning as we go along better methods for keeping and holding the attention of our membership.

I would suggest if any of the members here have in mind to organize local sections, that they layout a programme calling for meetings not too often. It is the tendency when anything of this sort is started, to begin with lots of enthusiasm, and people are apt to think that they can hold these meetings and nothing else. If you start in with an extensive programme of this sort, it soon peters out, and I would suggest meetings not oftener than one a month. Effort should be made to have topics very closely related to the everyday problems of the membership, and it is also very desirable to have aids, such as charts, moving pictures, and slides to illustrate the lectures. By all means have a black board for the speakers to use, specially if they are not very fluent speakers, like a great many of us, who like to turn to a black board when our English or French fails us.

(Applause).

THE PRESIDENT:—We are very much interested in these reports. Will some gentleman kindly second the adoption of these reports?

Seconded by Mr. Maclachlan.

(Adopted unanimously.)

THE PRESIDENT:—This is our last gathering, with the exception of the Executive Session, and there are one or two observations which I wish to make. I wish to extend my thanks for the active work of the members of the Executive Committee and those men who were in a position to be active, which is true of the members not only at other places, but those in Montreal, and particularly the First Vice-President, as well as his colleagues in Montreal. I have already alluded to the splendid work done by the Secretary-Treasurer, and I simply mention the fact again that throughout the year his services really could not have been better than they were.

I would like to make reference to the fact that the Second Vice-President has had very considerable duties during our meetings here, and let me say very sincerely and emphatically that I have been greatly interested in noting the excellent way Mr. Doddridge has been handling his part as Chairman of the Convention Committee here in Quebec.

It is a great pleasure to record my appreciation of the activities and works of others. Throughout my Presidency, I have been conscious, as I have already stated, of the kindness of all those by whom I have been surrounded. It has been a matter of very great gratification to me.

I am sure that I may on our behalf return to Mr. McDougall his kind words of interest in ourselves, which have been conveyed to us. Personally, and as President, I wish to have taken back to him the reciprocation of his kind remarks.

With reference to electrical matters generally, there has been a note of bitterness and misunderstanding, not in this Province, but in other parts of the Dominion of Canada. Personally I hope a better condition of feeling will exist, so that there may be no feeling of that sort, and so that all interested in electrical matters may find that they have a unity of purpose, unity of feeling, and a sort of uniformity in niceness of treatment, one of the other. So far as I individually am concerned, I never throughout my association with electrical matters have departed for one moment from the path which commended itself to me as proper and right. Speaking for those I represent, we have never for one moment strayed from what I consider the proper course.

I think that there is a wonderful opportunity now in the Province of Quebec to advertise the qualities and merits and virtues of privately owned interests. After all, no matter what we may say of ourselves, or any man may say of himself, or anything in the world may say of itself, there is nothing that so advertises anything as real merit upon the part of any desiring to be advertised. I am convinced of this, that the interests of the privately owned companies are quite safe in the hands of those who represent them in the Province of Quebec. It is obvious that with them largely will lie the duty of exhibiting the merits of privately owned corporations.

In conclusion I should like to endorse all that has been said as to the high position of electrical interests. That being so, it seems to me that we cannot too greatly emphasize every way that can possibly be adopted of getting co-operation. Those who are working together in a good cause cannot be too closely united. For that reason, as you see in this present session, we are associating ourselves with the Co-operative Association, under whose auspices we have our meeting tonight. Nor shall we forget the words we

have listened to this afternoon from our visitor, Mr. Bump as to the high position occupied by the electrical industry. I should not be content to be associated with anything which did not permit of the calling forth of the best in us, and when I say the best I do not mean the best of the hand and head alone, but the best of the heart also. (Applause).

MR. DION:—The convention is not complete, and would not be complete, without the motion which I claim the privilege to now move. My motion is, first, a vote of thanks to our retiring President for the manner in which he has filled the office. I shall not attempt to say any more about it. I shall not attempt to praise him because in the first place I do not feel equal to doing justice to the subject, and besides it would seem to me like an attempt to paint the lily. I shall say no more about that—you have seen him at work and you appreciate him as well as I do. I move that the thanks of the Association be formally presented to him and recorded in our books.

I would like in order to save time to suggest another motion, and couple with this, the thanks of this Association for the courtesies we have received at the hands of the people of Quebec. I shall not attempt to enumerate these courtesies or the people who were responsible for them. I shall leave it to the Secretary to make a proper list to put upon our records, in order that no one may be forgotten. We shall all carry with us, as we always do when we leave Quebec, the most pleasant memories. (Applause).

Seconded by the whole meeting.

THE PRESIDENT:—Of course there is nothing more to be said by me so far as the personal part is concerned, except to give you again my sincere thanks. As to the other reference with regard to the City of Quebec, of course I heartily sympathize.

SMOKING CONCERT ON 16th, OF JUNE.

On the evening of the 16th of June a Smoker was held in the Chateau Frontenac under the patronage of the Electrical Co-operative Association of the Province of Quebec, Mr. A. Munro Grier acted as Chairman. Besides the many entertainments which were provided, the following speeches were among the features of the evening.

MR. W. L. GOODWIN, at Smoker, June 16th.

Mr. Chairman and Gentlemen:—Really it is a shame to take this seriously tonight, and I am not going to do so. I was very much interested in the singing of "I'm Always Blowing Bubbles", as that reminds me of a meeting I attended in New York in February, 1917, just after arriving from California where I heard it said about myself: "That chap will have his tail between his legs in a couple of weeks, and be on his way back to California," because I have been blowing bubbles for this past many years about this conception of co-operation, and bringing it to your home town, and no one seems to know what it is all about.

After knocking around the coutnry with my good friend, Sam Chase, for four or five years in the different localities, telling those interested how they might be a part of this great organized electrical industry, by talking organization in their home town and making themselves a part of it, we are honoured here tonight, and I consider it a real honour to have the pleasure of standing on the same pltaform with Mr. A. Munro Grier, President of your Association, and our newly elected President of the National Association, Mr. Bump.

It is most interesting as we study the development of these two great organizations, to realize, that, properly, the great master minds of the electrical industry in these organizations have well spent their time for these past 31 years struggling with the great engineering and financial problems, affecting the upbuilding and development of the basic parts of the industry, and there is still much to be done in that respect. Because of highly technical nature of our business, these organizations took the form of technical organizations, and they shall perhaps ever be sustained as such.

But in struggling with these great technical problems, we seem to lose sight of two fundamental features of general and complete organization work. First, that all of our organized effort in the past has been more or less of a mutual nature, for nearly all of our work for the past 31 years has been largely within our own family, and second, the organization work and all the research that went with it were naturally dealt out to men of a technical or financial training within the industry. Very properly so, but two particulars which we must include, as Mr. Thornton so well brought out in his talk today at lunch, are that having developed this wonderful industry technically, we now come to a realization that it is time to develop plans to go out and sell this wonderful commodity to the public. In doing so we must provide a place in our organizations for salesmen in the industry and that, after all, is what these co-operative associations do. They bring to each man's home town an opportunity to make him and his work a part of this great organization, and it is not unreasonable to assume that in another three, four or five years the great Canadian Electrical Association and the great National Electrical Association will be tremendous active factors for good. There will be in every community on this continent meetings at least monthly, with every man in the electrical business feeling that he has a particular part to play in this drama—that is the thought Mr. Chase and I have had in our endeavor to start these local co-operative organizations. They are merely a stepping stone to one great electrical family.

Then the next serious or fundamental thing to remember is the fact that having acquired this wonderful technical knowledge of the electrical business, we have assumed that the great mass of people on this Continent have understood our mysterious language, but they have not. They have still to learn, or we have yet to learn a language and to speak a language that is comprehended by the average man on the street. It would be well for all of us to read the wonderful contribution of Mr. Kennedy, of the Southern California Edison, the book he wrote being entitled, "The Man on the Street." It is really a wonderful insight on the lack of understanding of technical men in marketing our commodity—electricity.

Now, another fundamental principle our organizations must learn:— we have not realized that, in order to draw the whole electrical industry ahead, each component part must be prosperous. It is said that without the prosperity of the central station group the electrical industry as a whole cannot be prosperous. Well said! And the contrary of that, unless the manufacturer, the jobber and contractor dealer are prosperous, the central station cannot be prosperous, because in these three groups of manufacturer, contractor-dealer and jobber, employees out number by several times the total number of people employed in the central station group, and if these additional groups are not going along in synchronism there is a break in the chain, so that we must find a common ground on which we can all participate and one boost the effort of the other.

Now perhaps a lot of our trouble in the past has been due to misunderstandings, difficulties which we have encountered, as in the case of the small retailer, small jobber, or small manufacturer, jealously watching one another. In order to build their small business, we must make them prosperous, then they will become great boosters for the whole electrical industry.

Another fault. Here's one of the greatest industries in the world, no doubt the greatest, and until the last few years we were without retail distribution. I mean retail distribution in the broadest sense. In most of the communities of this Continent, the public has been served by one retailer, and we have not yet gotten far ahead on the job, for unless we establish the many contacts the very nature of our business necessitates, and make common display of our utility business, as live merchants, we cannot hope to satisfy public demand. The public resents being compelled to accept one source of supply, even electricity.

In every other line of endeavor, at the slightest dissatisfaction, we transfer our trade to someone else. In the public utility end of our business, no matter how dissatisfied the public may become, they have little opportunity to transfer this business elsewhere, and so we are constantly subject to criticism on the part of the public. The manufacturer, dealer and contractor very often have wonderful opportunity to explain the peculiar position in which the public utility company is placed, and such explanations or such service rendered on the part of the dealers and jobbers, and manufacturers to the central station interests, merits and commends and brings forth the kind of support which you have in the testimony of tonight in Mr. Thornton and Mr. Norris, and many other men engaged in the utiilty business in this Province, in which they play their part to make your business successful.

Merely think and take every opportunity on your part to say a good word for them, and this will mean true spirit of co-operation and true exchange of service one to the other. It is a great privilege to play just a small part in the building of this co-operative idea. It is an honour and privilege to me tonight to tell you that I have just been nominated to take charge of the Society for Electrical Development, of which Mr. H. L. Doherty, President of the Company with which Mr. Bump is associated, was the first President and remained its President until one and a half years ago. This Society has accomplished a great many things, among them the "Say Merry Christmas Electrically" campaign, and other campaigns undertaken by the Society have brought to each community an opportunity for the men to get together and carry out these ideas in their community. In the future work of the Society we have no thought of overlapping or duplicating any of the work of any of the existing associations but to supplement them and to do such things as cannot be done by any other form of organization.

As to some of the things that seem to be desirable that the Society should undertake, there is a great need on this Continent for experienced men who are capable of going out and marketing the securities, not only of our public utilities but of the manufacturer, jobber and retail stores, that need money ever increasingly. We have an utter lack of trained, experienced men to meet the demand of marketing these securities. We shall undertake the formation of a school to train men for that highly important work.

Thrift League. There is a great opportunity to inoculate in the men of every electrical concern the thrift idea as applied to our own business. To give an example of what I have in mind. Would every man in this room

who is the owner of securities please raise his hand? Is it not inconceivable that we expect to meet success in asking the public to buy the securities of these great public utility companies when we reflect such confidence as evidenced by the raising of hands tonight? What you have seen tonight has happened all over this Continent. In Detroit, a year ago in a meeting of 50 men, 2 men raised their hands in reply to that question. We are going to start in the Society a Thrift League, in which we are going to ask every one of you men to invest in the securities of some public utility; and every dollar that is invested will be expended and reinvested in Canada. We are even willing to supplement your contributions, or your expenditures or investments, with an additional sum in order to give you encouragement to put this idea over. We want every man in the industry to take the obligation that within twelve months he will be the owner of a public utility security, or some security of the electrical industry, even though it may be only for one dollar. Once having acquired the habit of thrift and investing in our own industry, we will then be able to go forth with courage and confidence, and interest the people to invest, and we never can preach thrift until we practice it, and we should practice it in our own indsutry.

Next a legal department whose duties it will be to watch the tendencies of legislation. Only two weeks ago in Chicago was presented the most vindictive law that the electrical industry ever encountered, which if allowed to go on would have throttled the industry of that city. You have no legislation in Canada that has turned your industry inside out, but this legislation was ready to go on and become effective before we realized what it was about. Hence our need for a department of trained men who will study legislation and keep us informed. When this bill appeared in Chicago, every association was notified and asked to send three representatives to Chicago, and every Association stood up and reported its protest. Had this passed in Chicago it would have spread continent-wide.

An expert statistical department to compile data so that we may all have intelligent knowledge of our problems. Up to the present we have wandered like children in the night. We have need for essential data for every branch in the industry. The compilation of these statistics and their dissemination through the trade will enable you men to more intelligently direct your business. In addition to the credit notes, there is a tremendous demand for moneys to finance the ever-increasing instalment business that right today would absorb perhaps one billion dollars of money if it was available. We cannot sell appliances on this Continent to fill the demand with which the public responds, because we have not the money to finance the instalment business. We must find a way to do it, by providing you with men who will help you to develop in your district the ability to finance.

A speakers' committee, composed of men trained not only in the electrical business, but men trained to go before chambers of commerce, clubs, civic organizations, etc., in order to translate the message of the electrical industry to the business men and women of this country. We have no direct contact between the electrical industry and the great men of the public, and we need an organized institution to train speakers available in every community on this Continent to "get over" our message to the public. The public needs such a message, but we have no one trained to put it over.

Regional committees which will be formed through these organizations, that are ready to take up important questions, whatever they may be, and translate them to the public in their communities. Correspondence schools

that will be available to all men in the industry. 90% of the men who will manage the electrical industry in the future are coming from the mechanical class. Supply of men from our colleges and universities is not sufficient. We must provide training schools so that we shall have large number of technical men available for this retail business that is going on. Study of the text books, not only of the U. S. and Canada, but of the whole world. It is most interesting to study the text books of Germany and observe how that country has introduced into its institutions the message of the industry. Outside of the colleges there is practically nothing said about the electrical industry today, we should take the child and turn its mind to the electrical industry in the hope that we will have a uniform supply of trained talent coming through.

Those are just a few of the things we are going to undertake. We already have through the Society accomplished a great many things, and we have a great deal of available data at your command, through the call of Mr. Thornton and your Co-operative Society.

We are in this peculiar position, we have an organization quite unusual, an institution with a commercial end, but with an educational purpose, supported by business institutions with no direct return for their membership, an organization with an income of $120,000 per year, and a staff of some 28 are at your command. Whenever we can be of service to you, we are always too happy to do so. In August Mr. Chase and I will visit Halifax, and on our return we will be in Quebec on August 18th. If you gentlemen wish a meeting here, we will be very glad to take up such subjects as retailing, and will give formulas and information which we believe will help in solving business troubles in your localities. Any time we can be of service in any way, we are at your command, and of course there is no charge for any service we can render. (Applause).

MR. S. A. CHASE, at Smoker, June 16th.

Mr. Chairman and Gentlemen:—I did not prepare this programme. If I had prepared it, I should have put my name down first, ahead of Mr. Goodwin's. During the last four or five years I have prepared all the programmes and I was very careful to put my name down ahead of Bill's, and I always had the opportunity to talk before Bill, therefore the audience remained. Except in one place, in Jacksonville, I think it was, but perhaps it was Miami, I talked last, as I am talking tonight, and after I had got about half way through my talk I discovered there was only one man in the audience. After I went up and said "Thank you, old man, for staying through that speech," he said, "Hell, I had to stay. I'm the janitor."

Last night I made you a lot of promises. I was going to talk about the Goodwin plan, harmonizing the industry, about better wiring, becoming better business men, and so forth. But I am not going to keep that promise, because this would be impossible on account of the late hour.

We have been working hard, not only in the U. S. but in Canada as well, for several years, as you know, with splendid results, and only wish I had time to tell you all about it. A boy said tonight: "Sam, when you speak during the smoker, don't be serious." They know that usually I am serious in my talks. I said I wouldn't be serious, then I looked across the room and saw an old friend who has never heard one of my serious talks, and I thought perhaps I might lose some of the reputation that I have had with him for the last 35 years, so I am going to be serious, for a moment.

Last evening I told you that this was the first time I had been with Mr. Goodwin in a meeting of this sort since he became head of the Society for Electrical Development. Another strange coincidence happens in Quebec, a city I have always loved so well, and as you old timers know, I have always made excuses to get up to frequently. Before leaving New York, I wrote to 60 or 80 of my good friends on the subject of the Society for Electrical Development, appealing to them to become members, and telling them at considerable length why I suggested that they co-operate with the Society. To-night I have secured the first subscription. I am going to hand Bill a lot of them. I am going to take the liberty of reading this letter I received at Quebec:

"My dear Chase:—I am very glad to note the interest you are having in our welfare, in our future development in the electrical industry. It has been my intention after hearing the fine talk given at Hot Springs by Mr. Goodwin, that there was only one thing we had to do, and that was to join the Society for electrical development, and the opportunity you offer me is indeed most opportune, and I am taking advantage by enclosing cheque for $125, covering $500,000 volume of business which we had in the electrical supply line.

I noted with interest copy of Westinghouse Electric Mfg. Co. General Letter 499, and also the rebirth of the Society for Electrical Development.

Wishing you success at the Convention of the Canadian Electric Society, and with many thanks, I remain" (with cheque attached). (Applause).

I am going to take up about three minutes more of your time with this serious talk, and then I am going to tell a story. Several years ago I met Mr. Goodwin for the first time. After hearing Mr. Goodwin (I think he talked about two hours) I made up my mind that there was only one slogan that I could think of that was fitting for that great work he was going to start on—a work which I hoped later to join him in. That, as I have told some of you before, was the slogan "Live and Help Live." The reason I thought of that was, that it was a much better slogan than that old slogan of "Live and Let Live", because "live and help live" teaches true co-operation. Then later I thought of another slogan, and that was the slogan of "Co-operative Competition" instead of "Destructive Competition". I feel that we all follow that slogan just as well as fighting each other without reason. I am happy to say that all of the difficulties that we have experienced in the past in living up to those slogans in the U. S., and in Canada as well, have disappeared, and I feel in a great measure it was due to the following of the Goodwin plan, and all living up to this real slogan of "Live and Help Live." In other words, we have had, and now have the right attitude of mind, and that is the only foundation upon which we should endeavour to co-operate. I would like to talk to you at considerable length about these matters, but the hour is late and I promised not to talk seriously.

There is one thought I would like to leave with you and that is we do not always cash in on our opportunities. We don't in Canada or in the U. S. Do you know only about two weeks ago I discovered in New York City there were 177 women's clubs? About 15,000 are members of these women's clubs, yet we have not told them the story of letter service, of convenient outlets, and how to save work through the use of electrical appliances. 177 women's clubs, just think, in that one city alone. 15 to 16,000 members, and similar

clubs all over the U. S. and Canada. What an opportunity to demonstrate to these members the advantages of electrical appliances. What an opportunity to demonstrate the necessity for better wiring convenience outlets and yet no one seems to have thought of it.

I was going to talk tonight for an hour and Mr. Goodwin was going to talk another hour, on up-to-date wiring campaign and on convenience outlet campaign but time will not permit. Here is a reproduction of an actual scene in a dining room in Brooklyn, N.Y., where there were no convenient outlets in a new house completed 3 or 4 months ago. You see how the poor housewife had to get upon a chair and make connections with the chandelier over the dining room table. We have encouraged throughout the U. S. and Canada these convenience outlet campaigns, and are making wonderful progress in stimulating the addition of outlets.

Another chart I would talk if time would permit is this chart showing the wonderful progress in merchandise sales. Here's a reproduction of a chart prepared by "Electrical Merchandising". You can see the wonderful increase in the sale of merchandising appliances. You will notice that we just trailed along, practically doing nothing for years until a few years ago. I feel also that this remarkable showing is the result of co-operative work and association work, just like the work the co-operative association Mr. Thornton is the head of here is doing, but we have only scratched the surface.

Recently I heard a new definition of a pessimist. A pessimist is a man who has both belt and suspenders, for fear his trousers will fall off. Let's boost, not knock, let's be optimists and not pessimists.

In conclusion, I regret that the lateness of the hour makes it inadvisable for me to talk to you at length, but I would like to leave this one thought with you and that is that you follow this slogan I have told you about of "Live and Help Live" in your business relations with one another.

Thank you. (Applause).

MR. M. R. BUMP, at Smoker, June 16th.

Mr. Chairman and Gentlemen:—

I did not know when I talked this afternoon that I was supposed to save a part of my address for this evening, so it leaves me in a rather embarrassing position to get up and talk again. I am also informed that my good friend, Deacon Onken of the Electrical World, who kindly took my place last evening, also made my speech for me in advance and this leaves me still more at sea to present anything new to you.

The one great goal ahead of us is "Everything Electrical Everywhere", not only from the standpoint of selling service or selling appliances or manufacturing appliances, or wiring houses, but from the broad viewpoint of helping to promote the best good of the whole industry. We must all feel a sense of duty greater and more impelling than our own selfish ends. The foundation of success is co-operation in every branch of the industry and I believe the electrical industry is making a rapid stride in this direction. I have heard people who have been in attendance at national gatherings of other industries report that work of a co-operative nature, or of a progressive and constructive nature is at a low ebb. Our industry is about the only one I know of that seems to be conducting its business in a normal way and with confidence in the immediate future. We are beginning to realize that any man who is in any way interested in any part of the electrical industry is interested in it all. We cannot any of us be selfish. I want to say a word of warning to the central station man. He must be just as careful to safe-

guard the interests of the manufacturer, jobber and contractor as he is to safeguard his own rights, because it is only by creating a fair field for all and by giving every man in any branch of the industry a fair and full chance to succeed in his branch that we can hope to maintain that unity which is necessary to make the industry succeed as it should. If we can only realize the strength that lies behind unity and keep the big goal ahead of us, we are bound to progress. There may be differences from time to time between one branch of the industry and another, or between one corporation and another, but if those differences can only be viewed in the light of the fact that progress must be mutual and that the goal ahead is big enough for us all, they will soon be settled in a fair and amicable way. If we approach our problems in that spirit, I am sure we will find that the developments we have been talking about will become realities during the next four or five years. It was said at Chicago that the electrical industry will need $1,000,000,000 a year over the next five years in the United States alone. Surely there is room enough in a field as great as that for all of us to achieve success.

Co-operation in the electrical industry is getting its boost from the feeling of mutual interest. It has been a new industry and an industry with great possibilities, but it had not stood the test of time, it had not been through great crises such as the last four or five years have brought about and had not thoroughly substantiated its claim for permanence and pre-eminence as an industry. We can now go forward, having withstood the greatest possible test and having survived it honorably and with credit, and continue to proclaim to the world what a great industry we really have.

National associations are all right to educate their own people and the people directly connected with the industry, but they do not reach beyond those immediately connected with the membership. Every man in the industry has a duty to perform, in telling his friends outside the electrical industry of its wonderful possibilities. The fact is that around the magic word "electricity" is built up an industry that stands up and claims to the world that it is the best industry in the world and can prove it. We must reach the world with that message and we will find that our pathway will become lighter and our tasks become easier as the world becomes educated to this viewpoint.

We have not realized our own strength. We have not realized the added strength of united effort. We have been in many cases like the sleeping giant that did not know his own strength. Up to a short time ago very few men had vision enough to realize the tremendous possibilities of the industry. Only today are we beginning to get some idea of these possibilities. We must do our utmost to have the world realize them as fast as we can visualize them if we are to do our duty to the industry and to ourselves.

I am reminded of a little story that you have perhaps all heard, but whenever I think of co-operation and pulling together, and when I think of working with never a fear of failure, this little story comes to my mind.

Out in a Western railroad yard there was a heavy string of freight cars that had to be moved over the mountain. The crew started out to find an engine to take this string over the hill. They started down through the yard and every big engine was asked in turn as the crew came to it whether it felt big enough and strong enough to carry the string over the hill and in each instance there was a shower of sparks, a hissing of steam and the big

engine answered "I don't think I can; I don't think I can." Finally they came to the end of the yard and nothing was left but a little snub-nosed switchy engine. The same question was asked, and little switchy replied, 'Let's try; let's try.' So they got it out on the main line, coupled it up with the string of cars, and it said:

"I t-h-i-n-k I can, I t-h-i-n-k I can, I t-h-i-n-k I can, I t-h-i-n-k I can, I think I can, I think I can, I think I can, I think I can."

and over the hill it went.

Now, the moral is that we are all more or less like the snub-nosed switch engine and we must not be like the big engine that refused to try their power. Few of us realize the power that is in us for good until that power is put to the test. So, my message to you tonight is to get behind this game first, last and all the time and we will put it over and make the world believe and know that the one real, live industry, worthy of the confidence of every man, no matter where he may be, is the industry that is built around the magic word "Electricity." (Applause).

MR. K. B. THORNTON, at Smoker, June 16th.

Mr. Chairman and gentlemen, this meeting tonight is a good example of what constitutes co-operation.

When the Canadian Electrical Asociation were making the arrangements for their annual convention at Quebec they intimated that they were prepared to give the Electrical Co-Operative Association an evening during the convention in which we should have an opportunity of expressing our ideas on the co-operative movement.

In making this suggestion the officers of the Canadian Electrical Association evidently thoroughly appreciated what true co-operation meant, and the Electrical Co-Ooperative Association were only too pleased to avail themselves of such an opportunity.

The Electrical Co-Operative Association was formed about a year ago, but as might be expected there has been some considerable difficulty in getting the movement properly started, seeing that there is always some considerable inertia to overcome in getting any new movement properly going, and this fact is particularly true of our own Province of Quebec.

Our first move was to get together a strong Advisory Council, representative of the Manufacturers, Contractor-Dealers, Jobbers, Public Utilities, including Tramway and Telephone Companies, in fact representatives from everybody directly or indirectly associated with the electrical business.

In our Province we have had to take into consideration the fact that the largest percentage of the population is French, and consequently we arranged to have all our stationery, publications, etc., printed in both French and English.

It will be appreciated that on account of this fact we have been unable to avail ourselves of much good material which has been published in the United States, in connection with the co-operative movement, as we had to arrange, as stated above, for all our publications to be in two languages.

One of our first efforts was to induce the Contractor-Dealers, both French and English, to form themselves into Associations, as sections of the Co-Operative Association, and as a result many problems have been discussed and settled by the Contractor-Dealers Associations, with most beneficial results, and the Contractor-Dealers have also had conferences with the Jobbers Association, resulting in considerable mutual benefit.

As far as Public Utilities are concerned, I may say that during the past year there has been more co-operation on matters affecting Public Utility Companies then has ever been known before.

Of course our great trouble is to make everyone understand the aims of the Co-Operative Association,—holding meetings and talking does little good, and direct evidence of work actually accomplished is absolutely necessary.

Realizing that it was necessary to conduct a strong educational campaign in order to educate the public in the use of electrical equipment and appliances, we decided that the first thing to do was to start with the Architects and Builders, who were responsible for the erection of buildings, and for the facilities that might be placed in these buildings, for the use of electric power and lighting; through the courtesy of the National Electric Light Association we were able to secure a booklet entitled "The Modern Home", a copy of which was mailed to every architect in the Province of Quebec.

This little booklet has also been sent to the Builders and Contractors, and is full of illustrations showing the wiring facilities which may be installed in modern homes; we are most hopeful that we will obtain good results from same.

We have also received from the National Electric Light Association another booklet entitled "The Comforts and Conveniences of Electricity in the Home", which we are now having translated into French, and expect to have same ready for general circulation in the very near future, and these will be available for the use of the general public.

It had been hoped that this booklet would have been available for this convention but unfortunately owing to the delay in securing cuts for the illustrtaions, our efforts in this direction were nullified.

A very elaborate series of articles on the electrical industries in the Province of Quebec were also to have been prepared by an engineering paper in time for this convention, but unfortunately owing to the Printers' strike this educational information has not been available; however in spite of all these troubles and delays we have been able to show real results, thanks to the co-operative movement.

On each of the tables tonight you will find copies of our Constitution also a list of the names of men who are associated with us in this co-operative movement, as members of the Advisory Council, and I am quite sure that 9 out of 10 of these men are individually known to all of you, the fact alone, that these representative men are supporting the co-operative movement ought to be good evidence that as far as the Co-Operative Association is concerned, in the Province of Quebec, its success is assured.

We have been fortunate in inducing both Mr. Goodwin and Mr. Chase to come to Quebec, and as they are present with us this evening, and amongst the list of speakers, it seems rather futile for me to describe the possibilities of the co-operative movement, and I will therefore leave it to them to enlighten you more fully on the subject. (Applause).

THE END.


CANADIAN ELECTRICAL ASSOCIATION

PROCEEDINGS OF

ANNUAL CONVENTION

32nd Year

Canadian Electrical Association

HELD AT OTTAWA, ONTARIO

JUNE 15, 16 and 17, 1922

Office of the Association
65 McGILL COLLEGE AVENUE
MONTREAL, QUE.

WE respectfully suggest that our members take SPECIAL NOTICE of the advertisements distributed amongst the papers and discussions, and bear them in mind when in need of materials.

CANADIAN ELECTRICAL ASSOCIATION
INCORPORATED

EXECUTIVE COMMITTEE 1922-23

OFFICERS:

President:

P. T. DAVIES
Southern Canada Power Co., Coristine Bldg., Montreal, Que

Vice-Presidents:

R. J. BEAUMONT
The Shawinigan Water & Power Co., Montreal, Que.

A. P. DODDRIDGE
Quebec Rly. Light Heat & Power Co., Quebec City, Que.

L. W. PRATT
Hamilton Cataract Light & Traction Co., Hamilton, Ont.

Treasurer:

C. J. JOHNSTON
Southern Canada Power Co., Montreal, Que.

Secretary:

LOUIS KON
65 McGill College Ave., Montreal, Que.

MEMBERS:

CHAS. T. BARNES
The Toronto & Niagara Power Co., Toronto, Ont.

N. S. BRADEN
Canadian Westinghouse Co., Hamilton, Ont.

W. A. BUCKE
Canadian General Electric Co., Toronto, Ont.

A. B. COOPER
Ferranti Meter & Transformer Co., Toronto, Ont.

A. A. DION
The Ottawa Electric Co., Ottawa, Ont.

A. MUNRO GRIER, K.C.
Canadian Niagara Power Co., Toronto, Ont.

J. S. NORRIS
Montreal Light Heat & Power Co., Montreal, Que.

M. K. PIKE
Northern Electric Co., Montreal, Que.

J. C. SMITH
The Shawinigan Water & Power Co., Montreal, Que.

W. L. WESTON
Nova Scotia Tramway & Power Co., Halifax, N.S.

W. H. WINTER
The Bell Telephone Co., Montreal, Que.

J. B. WOODYATT
The Southern Canada Power Co., Montreal, Que.

THE PRESIDENT
National Electric Light Association N.Y.

ADVISORY COMMITTEE:

PAST PRESIDENTS ELIGIBLE FOR OFFICE

INDEX TO ADVERTISEMENTS

CONTENTS

PROCEEDINGS

The Thirty-second Annual Convention of the Canadian Electrical Association was held in Ottawa, Ont., at the Chateau Laurier on the 15th, 16th and 17th of June, 1922.

The attendance of delegates was quite satisfactory, a good portion of whom can be seen in the accompanying photograph.

OPENING SESSION.

THURSDAY, JUNE 15

President Julian C. Smith in chair.

THE CHAIRMAN:—Gentlemen, this Convention is now declared open.

The Executive Committee decided on holding this Convention in Ottawa, partly because of the pleasant recollections of previous times, and partly because we know very well the welcome and hospitality which all of us receive whenever we come to this very fine City. The Mayor of Ottawa has been good enough to come here this morning, and will say a few words to us. I introduce to you Mr. Plant, the Mayor of Ottawa.

Mr. Chairman and gentlemen, I do not know whether you have come here with the idea of discussing the question of increasing the rates of electricity, or to reduce the rates of electricity. However, Mr. President, I am going to take a chance, and extend to you a very hearty welcome to our City.

We are always pleased in Ottawa to welcome conventions. We are proud of our City, as we feel we have a very nice one. I have no doubt that when you gentlemen go around our City (and most of you have been here before), you will agree with me that we have very splendid prospects for industrial possibilities. Your experienced eyes no doubt will see and appreciate our abundant water supply, part of which is not yet harnessed.

Now, I have had a chat with Mr. Dion, and as Mayor of the City I may say I am also a member of the Ottawa Hydro-Electric Commission, and I would like to see the day when the privately owned electric companies and the municipally owned electric companies will come together in discussing matters of this nature, because I feel it is very beneficial that men in this particular branch of business, whether it be municipally or privately owned, should get together and discuss technical problems and commercial problems. We in Ottawa have a very splendid electric light plant, privately owned, and we have a very splendid municipal owned plant. These two concerns get along very well together. When they want to scrap with us we won't scrap with them, and when

we want them to scrap with us, they won't, so for that reason we get along nicely together. We owe a great deal in Ottawa in an electrical way to Mr. Thos. Ahearn and Mr. Warren Y. Soper. We feel that through them we have in Ottawa a street railway system second to none on the Continent, and through them they have worked up a most splendid electric light and power business in our Ottawa Electric and Gas Companies. (Applause.)

I know you did not come here to receive an address from me on technicalities or anything of that kind. As a matter of fact, I do not know enough about it to enter into technicalities, and I am going to leave that to you men, because I see by your paper you have reports and papers which will be beneficial, I am sure, to you.

It is very fitting, as your President said, that you should come to Ottawa for more reasons than one. He spoke of the hospitalities you have had in previous years; and then don't forget, gentlemen, our Electric Railway Company has two lines, both running to the City of Hull. (Laughter.)

We are very proud of our City and you have come at a good time of the year to see it, because we have an abundance of beautiful parks and driveways, but we do not want to be selfish, and if any of you gentlemen wish to view our neighbouring City, Hull, and look up the abundant water powers over there, I am sure you will go with all the blessing of the people of Ottawa (and no doubt you will meet a lot of Ottawa people there). You will be welcomed back and doubly welcomed back, if you bring something with you. As Mayor of the City, I am also a member of the Police Commission, and if any of you gentlemen get into trouble in Hull, or on your way back, if you will look me up I may endeavour to have the same friendly relations restored as you had when you went over. (Laughter).

I sincerely hope that your sojurn here will be enjoyable. I know that in the hands of these gentlemen, and Mr. Dion (who is taking a very keen interest in this entertainment from Ottawa's end, and of whom I can say the highest words of praise in all matters that come up as between the Ottawa Electric and the City of Ottawa—we get along very well together). From what I know of his very genial disposition, and of his particular qualifications, I know that you gentlemen are going to be royally entertained in our City.

While I am kept pretty well on the move, I hope that time will permit of my being able to be at one or more of your sessions, so that I may hear some of the discussion, and perhaps become better enlightened, and better able to fill my position as Commissioner of the Ottawa Hydro Commission.

I thank you, gentlemen, and on behalf of the citizens of Ottawa, I want to extend to you a very warm and heartfelt welcome, and hope that the entertainment will be such in the hands of the Committee that ere long you will come back, as a body, or individuals, when you will receive the same hospitality. (Applause).

THE PRESIDENT:—Gentlemen, I am sure that after such a very kindly address as his Honour, the Mayor, has given us, that the President should give a word of warning to our members, as they might possibly go to greater extremes than the dignity of the Canadian Electrical Association would warrant. Mr. Mayor, you tread on dangerous ground when you make such rash promises as you did. You don't know the Canadian Electrical Association. However, gentlemen, I am sure we all might take a chance. We are all very glad to be here, and we are confident that our trip will be one of great pleasure.

It has been the custom, gentlemen, for many years at these meetings, for the President to say a few words dealing with the affairs of our Association. In view of the long programme that we have later, I have felt that it would be inadvisable to carry you through a long address, and while there is a great deal that might be said, I have taken this matter up with our Secretary, and I have touched upon certain points, and our Secretary has brought in a few others that I believe are of importance in bringing to your attention.

In addressing you this morning for a short time, I am sure our guests will pardon me if I make a few comments and suggestions about our own Association, its needs and policy.

To be of value any organization must be powerful in its own field. Power indicates strength, and so the Canadian Electrical Association must continue to increase its membership, and thereby gain in influence and also in financial ability to carry out whatever policy may be decided on. We do not want a tea party, we want an Association clear headed in its ideas, and strong enough to go out and demand, if need be, those things which will benefit not only our Association, but also the whole people of Canada. The individual growth of a Nation may now be measured by the per capita use of power. Canada, like all the highly civilized countries, is rapidly changing from an agricultural state to an industrial state. This change can only go on with power used on an ever-increasing scale, so our own industry, which is fundamentally based on the use of power, must use all proper methods to encourage and direct the development of the use of power in Canada.

I think the time has arrived when this Association should adopt the principle of a permanently paid Executive-Secretary, and I ask your consideration of this important matter.

We should change our by-laws so that the position of Secretary-Manager is created, and the post should carry compensation enough to justify the efforts we want.

When I assumed the office of President of this Association a year ago — an honour, gentlemen, which I assure you I deeply appreciate — I determined, that, if possible, I would continue the very able work so well carried on by my predecessor in office, and also try to carry out especially certain policies which I thought were of great importance.

The increase of membership has had the earnest consideration of our Executive Committee. A Special Committee was appointed to deal

with this matter, and the result was that our total membership was increased by 176, an increase of 56 per cent.

There are still a few important public utility companies who are not members of our Association.

We need these Companies, we want the help and advice of the Executives who head them, and we believe that the Canadian Electrical Association gives in return benefits which more than compensate for the time and money involved.

We have developed another innovation this year. The large Executive Committee proved too large and difficult to get together frequently. We created a small Committee which met on several occasions and which assisted materially in the transaction of the business of the Association.

Our Special Committees have worked hard, and the reports you will receive at this Convention bear witness to the fact that the Committee Members and Chairman have given liberally of their time and ability for the good of the Association.

We have kept in constant touch with the N.E.L.A.

Personally, I have been unable to attend the many meetings and discussions to which I have been asked, but I have sent our Secretary to all the important ones, and his reports are very interesting and valuable. I am sure, too, that he was able to give something also to the meetings which he attended, as well as receive a great deal.

We started a circular letter to the Members with the thought that more interest and co-operation in the Canadian Electrical Association would result. Judging by the many letters received the plan was successful, and the next President may find the scheme well worth carrying on, possibly on a broader scale.

An important step was taken during the year by the incorporation of the Association by Letters Patent of the Dominion of Canada. Previously, we had no legal status, and strictly speaking had no right to function, collect money, own property, or do any of the things which we have been doing for many years. We now have a Charter, and at this Convention the change will be made of taking all the old members into the new incorporated Canadian Electrical Association.

The new By-laws are practically the same as the old, and so far as the members are concerned, the whole affair is only a formality which must be gone through with, to insure the Canadian Electrical Association a position from which it can go on in the future.

The finances of the Canadian Electrical Association are good. You will hear the report of the Secretary-Treasurer, and will note that we have a balance left, after paying all our expenses.

In connection with the finance, we have deemed it wise to appoint a firm of Chartered Accountants as Auditors of the Canadian Electrical Association. The Auditor's report is attached to the general statement.

Before closing this part of my report, I wish to express my appreciation of the co-operation and help which all the members of the Canadian Electrical Association Executive Committee have rendered

during the year. They have all worked hard and if anything good has been accomplished, it is due principally to the work of each individual member of the Executive Committee.

It is dangerous to pick out special men to thank, but I am sure that the men on the Committee will agree with me that Mr. Dion has been a tower of strength and help to the President throughout the year, and has always been willing to take on any burden suggested. It is largely due to Mr. Dion that this Convention is such a splendid success. Mr. Dion, on behalf of the Canadian Electrical Association, permit me to express our thanks to you and your colleagues for the great work they have done here.

To turn to another subject for a few minutes, I wish to speak of certain features of our own industry. A very able Department of the Government — The Water Power Branch — headed by Mr. J. B. Challies, has published during the past year some exceedingly interesting and valuable reports on water powers and the growth and use of water powers in Canada.

I do not desire to repeat what these reports indicate except the summary, that the power capacity of waterpower stations used for all purposes is at present increasing at the rate of about 200,000 h.p. per year. It may be fairly stated that at least three-quarters of this amount is for electric station use, and represents the growth of our own industry in Canada. It seems probable that for a number of years this rate of increase will be maintained or exceeded.

Taking the capital cost, including all items of financing, etc., into consideration, there must be invested at least $200 for every horsepower, to deliver that power to the consumer. 150,000 h.p. at $200 per h.p. means an investment of $30,000,000 in capital expenditure for this kind of work. A little less than half of this amount is financed in Ontario by the Government owned utilities, and the balance we must look for through the investment houses of Canada.

Hydro-electric utility bonds and other forms of security have and are enjoying a well-deserved reputation in Canada. I want to press this phase of the situation forward, because in this country we hear a great deal of the engineering, operating and political sides of the problem, and not so much of the most important of all — the financial and economic.

Knowing the local conditions, engineers and operators, Members of this Association, can build and operate plants in Canada better than any others. We are just beginning in a big way to do this work. I want to urge upon all our members to think first of all of the financial sides of their problem. The best engineering is really the cheapest, but the management should, and must, exercise the greatest economy in all capital expenditures.

In the early stages of the financing, a careful balance must be maintained between the needs of the enterprise and the cost of financing. Many a good scheme has been badly crippled for life by starting out carrying too heavy a burden. For several years past the cost of finan-

cing has been so high that only our best companies could afford to do anything.

In 1912 the average cost of money to good hydro-electric enterprises was about 5 per cent. In 1921 this cost had increased to about 8 per cent. or 9 per cent., a prohibitive figure for expansion.

In 1922 we see an improved condition, the good companies can finance to-day for about 6 per cent. to 6½ per cent., and we are confident that within a year we can get money on a 5½ per cent. to 6 per cent. basis.

This is a vital matter, as it means we can now look forward to the development on a large scale of our waterpower resources, and further we can make plans for such development reaching several years into the future.

The fact that money is getting cheaper will also push higher the market value of those dividend paying stocks that pay from 6 per cent. to 8 per cent., and as these stocks go up the whole question of raising new capital for more extensions gets easier.

There is no enterprise more affected by the cost of money than the development of waterpowers. The cost of power on the bus bars of a waterpower station is made up of about 85 per cent. interest charges and 15 per cent. operation, maintenance and taxes. Just a word about taxes.

Taxes, which before the war constituted only about 1 per cent. of the total cost of power, now amount to some 7 per cent. or 8 per cent., and in many cases are equal to or greater than the combined operation and maintenance. This matter is of importance in considering Government owned as against privately owned utilities. It is also important as a powerful urge to our Association to co-operate with others in working out the problems of this country so that taxation may be reduced.

And now, as I have nearly finished, I want to make a plea for this Association. It is evident, I think, from the remarks I have made, that there is in Canada a great need for just the kind of an Association that we represent. We should do everything possible to strengthen the hands of the Executive of the Canadian Electrical Association, and both with money and work help build up a strong able Association, which in turn will be of great use to the electrical industry in Canada.

SECRETARY:—Mr. President, before I start reading my report, I would like to make a few announcements. If any of the delegates have not registered, I would request them to do so as soon as this meeting is over. All railway certificates, even if they have not been signed previously, should he handed over to Mr. Phee. They will be returned to-morrow afternoon, but they have to be certified by the Railway Association, in order to get the reduced fare on the return journey. I would also request that all delegates buy the strip of tickets to-day, in order that the Committee arranging the various entertainments may know the exact number who will attend the different functions. I want to

announce also that for the ladies who are attending the Convention, there will be a drive and afternoon tea at the Rivermead Golf Club this afternoon. Party will leave at 2.30 in front of the Chateau, in motor cars, and will be in charge of Mr. Anscombe. I want to also announce that there will be a meeting of the Accounting Section at 3 o'clock this afternoon in the banquet room of this hotel. There will also be a group photograph taken at 12.30 outside on the terrace.

REPORT OF SECRETARY-TREASURER, 1921-22

Mr. President and Members of the Canadian Electrical Association:

With the close of another year in the history of the Canadian Electrical Association, your Secretary deems it advisable to summarize briefly some of the work accomplished during the last twelve months. The President in his address touched upon some of these features, so that I shall confine my remarks to points not already covered.

It was the object of your Executive at the beginning of the present year to concentrate upon a few subjects and obtain tangible results thereon. This to a large extent has been carried on.

Further to what has been already stated should be mentioned, that, as a natural sequence to the desire for closer contact and greater co-operation with electrical bodies in Canada, the Canadian Electrical Council has been organized with Dr. Walter Carr, of the "Electrical News," as Chairman. The Council has no authoritative, or executive, power, but is to act as a clearing centre on matters of interest to the electrical fraternity in general.

In reference to the extension of the seal period of meters, through the auspices of your Association, a petition to the Hon. Minister of Trade and Commerce was signed by owners of more than 630,000 meters, or roughly 90 per cent. of the total number of meters installed in Canada. This was bound in a book and presented to the Minister by a special delegation. The results, however, were not as successful for the time being as might have been expected. This was possibly due to certain people who failed to appreciate the justice of the demand, as well as overlooking the great waste of money every year under the present regulations. The special committee looking after this matter, in conjunction with the Meter Committee, are accumulating further data on the testing of meters, and we may sincerely hope that ultimately proper legislation may be obtained to prevent such useless waste as exists at present.

There has been during the year greater interest in the affairs of the Association in general than had been the case for a few years past, as much among executives of companies as among operating staffs and others. This a most important factor which should be constantly kept in mind if the Association is to attain the high sphere of influence which it is properly entitled to. High officials are the ones most depended upon to

properly direct the policies to be followed, and should whenever possible willingly give of their time, as well as give complete and thorough support to members of their companies who are representatives on Committees. It should also be remembered by employees that by devoting themselves and giving of their knowledge, they not only advance the general progress of the Association and the electrical business in general, but also are promoting their own interests by becoming of greater value to their employers and making themselves eligible for positions of greater responsibilities. Indeed, it is by thorough co-operation and *esprit de corps*, as well as unselfishness on the part of everyone, that the Association will become an outstanding organization in Canada and be of real service to its members and the industry as a whole.

The personnel of the various Committees during the past year consisted of 54 people, representative of the various branches of the industry. Generally speaking, meetings were fairly well attended, and the reports which will be presented for discussion at this Convention are the results of the year's work.

This last year a new Company Employees' Section was founded in Montreal. Several meetings were held at which papers of a decidedly high order were presented and the discussions proved also of considerable interest to those present.

The Toronto Section has been carrying on as in the past, while the St. Maurice Valley Section, which was formed last year, held its own and also had a successful year.

Our relationship with the N.E.L.A., our parent association, has been, as in the past, of a most cordial nature. While one or two of the committees were somewhat delayed in obtaining data required, due to late appointments, these matters have been adjusted to the satisfaction of those concerned. This year your Secretary would strongly advise appointing the Chairmen of the various committees at the Executive Session of the Convention in order to avoid delay in starting the work for the coming year and enable all of the Chairmen to attend the first N.E.L.A. meetings of their respective committees. Your Secretary attended three of the meetings of the N.E.L.A. Executive Committee and the Convention at Atlantic City.

One of the outstanding features of the year's work by the N.E.L.A. was undoubtedly the Murray & Flood report, as a result of their investigation of the Hydro Electric Power Commission of Ontario. The report has been sent to all Company members as well as to a great many individual members upon request.

As for business development in the electrical field, which after all is undoubtedly to a considerable extent the sap which feeds and gives the life to the various branches of the industry, the N.E.L.A. has taken for the year's slogan "More and Better Business." To look after this department the services of Mr. H. A. Lane have been secured, and as he is in attendance at this Convention, we shall have the pleasure of hearing from him the message which he has in store for us. At Atlantic City

a month ago it was stated that over $350,000,000 had already been spent on developments and extensions since the beginning of the year in the United States and that in all likelihood the billion dollar mark would be reached before the end of the year. Our President a moment ago gave us some figures as to what could be expected in Canada as our legitimate share of this prosperity.

This report would not be complete without making reference to the death during the year of two pioneers in the electrical field in Canada. The first one is Senator Nicholls, of Toronto, who had been untiring in his efforts during his lifetime towards the promotion of anything that could further the advancement of the electrical industry. He had the signal honour of having been the only Canadian ever elected to the presidency of the N.E.L.A. The second is Mr. A. A. Wright, of Renfrew, Ont., who had been all his life in the electrical business and had for a number of years been actively associated with the Canadian Electrical Association, having held the post of President.

Coming now to the financial condition of the Association, your Treasurer begs to report that after paying all expenses, which were much higher than the previous year, owing to enlarged activities of all sorts, we close the year with a balance of $3,155.50 in the bank, and total assets of $5,650.95, which is higher by a few hundred dollars than at any times previously.

In view of the fact that this is my last term in office, I wish to take this opportunity to express to you all my gratitude for the great help which has been rendered to me at all times and which facilitated my task to a considerable extent. During these last two years I have given much of my time with the sincere purpose of building up the Association and giving it its proper place of influence in the electrical world in Canada. If by my humble efforts the new structure now on its way to bigger things ultimately reaches the pinnacle in mind, I for one shall feel amply repaid for what I have been able to do in that direction.

Respectfully submitted,

EUGENE VINET, *Secretary-Treasurer.*

STATEMENT OF RECEIPTS AND DISBURSEMENTS, TWELVE MONTHS ENDED MAY 21, 1922.

RECEIPTS

BALANCE AS AT JUNE 1, 1921.			
Cash in Bank		$4,787.22	
Cash on hand		33.97	
Victory Bonds, maturing 1933 par		700.00	
			$5,521.19
Membership dues class A. Fixed	$1,465.00		
" " " A. Percentage	3,045.75		
" " " B.	870.00		
" " " C.	80.00		
" " " D.	1,305.00		
" " " E.	162.00		
" " " F.	290.00		
" " " G.	54.00		
		$7,271.75	
Income from Advertisements in "Proceedings"		585.00	
Interest from Victory Bonds		113.37	
Donation for Resuscitation Medal		50.00	
Miscellaneous Income		194.59	
			8,214.71
			$13,735.90

EXPENDITURE

N.E.L.A. 50 p.c. of Membership Dues	$3,640.38	
Handbooks, Reports, etc.	67.07	
Local Sections, 50c per member	128.50	
Honorarium, Secretary-Treasurer	1,000.00	
Proceedings	884.27	
Convention and Traveling Expenses	665.99	
Printing and Stationery	785.01	
Office Expense	567.43	
Steel Die for Medals	60.00	
Addressing Machine and Cabinet	84.20	
Incorporation Expense	202.10	
		8,084.95
Balances at May 31, 1922		
Cash in Bank	3,155.50	
Cash on hand	34.65	
Victory Bonds due 1933, par $2,500.	2,460.80	
		5,650.95
		$13,735.90

Audited and verified as per our Report of this date.

SHARPE, MILNE & CO, *Chartered Accountants.*

Montreal, June 12, 1922. Certified Correct

EUGENE VINET, *Secretary-Treasurer.*

(Applause)

MONTREAL, JUNE 12, 1922.

The President and Members,
Canadian Electrical Association,
Montreal.

GENTLEMEN:—We have audited the Books and Accounts of your Association for the fiscal year ended May 31, 1922 and have prepared and attached hereto Statement of Receipts and Disbursements for that period, duly certified.

Satisfactory receipts have been produced covering disbursements and cash in bank and on hand and securities have been verified.

We have accepted as correct the list of members presented to us by your Secretary and have checked the dues received against this list. Subscriptions in arrears amount to $155.00, and owing to the uncertainty of collecting this sum no cognizance has been taken of it in the statement submitted herewith.

CERTIFICATE

We have received all the information and explanations we have required and we certify that, subject to the above report, the attached statement is properly drawn up so as to exhibit a true and correct view of the financial position of Canadian Electrical Association, according to the best of our information, the explanations given to us and as shown by the books of the Association.

Respectfully submitted,
SHARPE, MILNE & CO., *Chartered Accountants.*

MAYOR:—Mr. President and gentlemen, I have listened with a great deal of pleasure to the reports of the President and Secretary. I am sorry that I will have to move along, but I see lots of Ottawa boys here, and I know you will be in good hands, as they are not only a credit to their Companies, but to the City. Ask anything of them — they will look after all your wants, no matter what they may be. (Applause).

JOHN MURPHY:—The mention of the names of the late Senator Nicholls, and the late Mr. Wright, reminds me of the death of Mr. J. J. Wright, of Toronto, and Mr. B. F. Ressor, of Lindsay, also well known to all the old members and past Presidents of this Association. If this is the proper time, I think it would be well to pass resolutions of sympathy.

PRESIDENT:—Is it your wish that the Secretary draft proper resolution of sympathy on the death of Mr. J. J. Wright and Mr. B. F. Ressor, formerly members of this Association? (Unanimous decision rendered). Moved by Mr. Murphy and carried unanimously.

We will now pass to the reports of our Committees. The first report is that of the Membership Committee. Mr. Pike, Chairman of the Committee, is here, and I will ask him to present the report.

M. K. PIKE:—Mr. President, it gives me a great deal of pleasure, as Chairman of the Membership Committee, to report the following increase in the membership of the Association this year.

Class A members	New members 6	Cancellation 1	Net gain 5
" B "	" 149	" 10	" 139
" C "	" 2	" 3	Net loss 1
" D "	" 8	" –	
" E "	" 44	" 3	Net gain 41
" F "	" 8	" 1	" 7
" G "	" 6	" 28	Net loss 22

We have therefore 223 new members, with 46 cancellations, or a net gain of 177, or 56 per cent.

I would like to say that we attempted to organize a membership campaign week, which I think was successful. We appointed a very representative committee, reaching almost from coast to coast. We were unfortunate in not being able to get the western Provinces very much interested. This gain is in the eastern provinces. I would recommend that the Committee next year follow out the same, or a similar scheme, in having a representative committee appointed, and perhaps have a campaign week. I believe that is really the only way the membership can be increased as it should. Class A Members are, of course, most important to the Association from a financial standpoint, and it is hoped that some means will be found to increase the Class A membership. I think that it is all the Membership Committee have to report. (Applause).

PRESIDENT:—Report of the Public Relations Section, Mr. Woodyatt.

REPORT OF THE COMMITTEE ON PUBLIC RELATIONS.

Owing to the geographical and political situation of our member companies, it has been peculiarly difficult to make any progress in the matter of furthering the work of the Committee on Public Relations in Canada along lines parallel to those along which the parent committee of the N.E.L.A. are endeavouring to promote and stimulate a better understanding on the part of the public of the responsibilities of the electrical utilities to the public, and the responsibilities of the public toward the utilities.

The committee of the N.E.L.A. has accomplished much, and will undoubtedly accomplish a great deal in the future. It is working along very broad lines, and the following sub-divisions will give an idea of the scope of the work intended:

1. WOMEN'S PUBLIC INFORMATION COMMITTEE:—To formulate and put into effect plans for the education of women of the country on the fundamental economic principles of the electric light and power business and the interdependence of the public and the industry;

2. EMPLOYEE RELATIONS WITH THE PUBLIC COMMITTEE:—To foster, through the executives of member companies the proper education of employees in the fundamental economic principles of the light and power business, in the proper understanding of the inter-relation of the public and the industry, and in the proper handling of complaints and courtesy to the public;

3. PUBLIC SPEAKING COMMITTEE:—To organize through the Geographic Divisions a bureau of public speakers, national in its scope, and dealing with subjects pertaining to the electric light and power industry.

4. RELATIONS WITH BANKERS' COMMITTEE:—To have general supervision of all co-operative work with investment bankers, bankers, insurance companies, etc.

5. ADVERTISING:—To induce the large advertisers amongst those interested in the manufacture of electrical materials, as well as those interested in the purchasing and handling of public utility securities, to devote a part of their appropriations to the spreading of proper information concerning the fundamental economic principles of the electric light and power businesses, and the interdependence of the public and the industry — in addition to committees on local organization of public information, and on uniformity of local regulatory laws.

Your Chairman attended the meeting of this Committee in New York last October and was very much impressed with the work being accomplished. The results of the work of the Committee are clearly shown by the rapidly increasing interest that is being taken by the public in the securities of light and power companies, and whereas until comparatively recently, perhaps, the securities of these companies were held by comparatively few large investors, they are now finding their way into the hands of the smallest customers of the light and power companies and in such substantial quantities in the aggregate as to create an entirely different feeling on the part of the public towards these companies. It is needless to point out that a customer is much more appreciative of the problems of the companies, and much more sympathetic in his viewpoint as to the working out of these problems after he has become a shareholder. As the public come to have a better understanding of the interrelation of the public and the industry, and as the public generally become more and more interested financially in the stocks of the companies, the relations between the companies and the public they serve will permit the entire industry to progress as it should to the benefit of all.

After studying the work of this Committee, and the methods whereby it could be applied to our own Association, your Chairman reluctantly came to the conclusion that our Canadian situation did not permit of the centralization of this work on our side of the line, and so reported to the Executive Committee, with the result that the Committee was not made effective. Here we have a group of companies in the Province of Quebec, whose problems are very similar, and who can work together

to advantage to promote the proper relations between the public and the industry. In Ontario the few remaining private companies have an entirely different problem on their hands. These central groups are separated from our other member companies by distances that render our meetings most infrequent, and without meetings it is not easy to arrive at a sufficiently clear understanding of local situations to enable effective co-operation. On account of the dissimilarity of local situations and the impracticability of frequent meetings, it is felt that more can be accomplished by the organization of local groups than through a Central Committee.

The Co-operative Electrical Association of the Province of Quebec has been formed to take in all branches of the industry in the Province, including the light and power companies, the manufacturers, jobbers, contractor-dealers, consulting engineers, and all others in any way interested in the progress of the electric industry. This Association is getting well under way, and we have every reason to expect that it will be able to accomplish the purposes for which it was formed, and it is through Associations of this kind that the work of improving the relations between the public and the industry can be furthered to the greatest extent in this country, as with all the different branches of the industry itself working with a better understanding of each others' responsibilities and requirements, the education of the public in the proper understanding of the interrelation of the public and the industry should be a much less difficult matter.

As the Committee was not made effective, the Chairman can only speak for himself, and would recommend that your Association undertake the promotion of the formation of Associations similar to that in Quebec, for each locality throughout the country, in which those forming the Associations would be readily within reach of each other; and that the work of improving the relations between the public and the industry be carried on along the lines laid down by the National Electric Light Association Committee through Committees of these local Associations, and that these Committees keep in touch with the similar Committees of the Main Committee of the N.E.L.A. through the Secretary of this Association.

As the ownership of the securities of the companies by their customers, and the education of the public necessary to bring about this ownership, is probably the greatest single factor in the betterment of relations between the public and the companies, we would recommend that the matter of organizing the campaign for the sale of securities to its customers be given consideration at the earliest opportunity by each member. Improvement of relations between the public and the company in any locality is bound to have a beneficial effect in other localities, so that anything that can be done along these lines by a member company will not only greatly improve its own position, but also improve the general situation to the benefit of the entire industry. (Applause)

J. B. WOODYATT, *Chairman.*

PRESIDENT:—Gentlemen, I see my friend, the past president, is in the room with us, and I want him to come up and help me to carry the burden of this meeting. (Applause)

Will you say a few words as past president?

A. MONROE GRIER:—Mr. President and gentlemen, I need not tell you that this is entirely a matter of surprise to me, because you know as much about the whole circumstance as I know. I have just been asked, as the President has told you, to come up here and help to carry the burden. He discharges his duty with such ease, it is evidently no burden, and there is no reason to help carry a burden which does not exist.

I am, however, quite unwilling to let pass the opportunity to pay my tribute to what has gone forward this morning in the direction of the report by the President and by the Secretary-Treasurer of the Association. I am convinced that all of us must have been very greatly impressed, not only with the fact that the reports themselves were of so cheerful and fine a character, but that those who were responsible for them are so evidently fitted for the responsible position which they occupy. (Applause)

PRESIDENT:—It is dangerous, I think, to ask a legal gentleman to make a speech. One never knows what he is going to say.

We have a few moments to spare, according to our programme. There is an Executive Session at 12.15 for Classes A and D; and I will throw the meeting open now for a general discussion. There won't be much opportunity, except on Saturday morning, for Classes A and D, so I trust that we will have some discussion this morning on any matters of interest to these Classes, or any suggestions that the members may have for the next Executive Committee to follow out. The meeting is open. I ask Mr. Winter if he will start some discussion.

W. H. WINTER:—Mr. President, this is rather a surprise to be called upon to speak to the Association. It has been very pleasant for me to be here and as one of the very old members of this Association and looking back over a number of years, to now realize that our Association is coming to a position and standing in the country that will undoubtedly be of great advantage to all the Electrical interests.

The Telephone Company in the early days of the Canadian Electrical Association was a very active member of the Association and in fact I think we were in the majority as members. With the development of the power and lighting interests in the Association the activities did not include the telephone interests, as it was generally considered that we did not line up with the electric light and power business, but to-day we are very much interested in their problems as it affects us, in fact we have a real problem to operate a telephone system on account of the increased development to power systems, and although the report which will be read later on "Interference" is not complete, it shows that the Association is working along towards the point where the telephone and power people will know each other better

and also I think that the Committee, working together, will solve some of the problems that are confronting us.

For the improving of relations between Public Utilities I would strongly recommend getting closer together. In Montreal some years ago, a few gentlemen of the electrical and allied interests got together and organized a weekly luncheon which has been carried on successfully and which, all members agree, has been a large factor in bringing about better relations between Companies and also has helped in the efforts for better Public Relations. Good Public Relations is important for all Public Utilities and I am glad to see that this subject is one that is particularly emphasized in some of the work that is being carried out.

I endorse all that has been said by you, Mr. Chairman, and appreciate very much being able to be present and hear the splendid reports of the various Committees and also wish to say that, although I have not written to the Secretary appreciating the monthly letters sent out by the Secretary in regard to the activities of the Association, they contained matters of real interest to our Engineering Department and if, as a member, the Bell Telephone Company has been able to assist the Association, they have also been repaid by the benefits derived. (Applause).

PRESIDENT:—I see my friend, Dr. Carr, in the back of the room. Dr. Carr, will you add to this discussion a little?

DR. CARR:—Mr. President and gentlemen, I don't know what I can say unless it may be a word about the Canadian Electrical Council that your Secretary spoke of in his report. That Council was formed with the idea that matters of common interest between the C. E. A. and the A. M. E. U. (which is short for the Association of Municipal Electrical Utilities of the Province of Ontario) might be discussed around the same table. One of the aspirations of that Council was that a common convention of the two associations might be held, possibly during the present summer, and it looked at one time as if this might become an accomplished fact. However, there appear to have been certain difficulties in the way, after the announcement was made that the C.E.A. would hold their Convention in Ottawa, but at one time it did look as if the A. M. E. U. would favour a common convention.

Commenting on the retail end of the business, Dr. Carr said:

The weakness seems to be with the contractor and dealer and more particularly with the latter. We have not yet developed a merchant class in Canada that is capable of taking care of the manufactured article and passing it along to the consumer. I often feel that we spend too much time urging the public to buy appliances before providing proper stores where they may be bought; also in most cases they cannot use the appliances if they do buy them because their homes are too poorly wired. Our stores are not up to standard. The other day I went into a store recently opened in Toronto. I had been advised that a certain man had opened a new store on College Street. With difficulty I located it as an electric store. It had a few condulets and

some pipe and wire in the window. When I finally located it and walked in, there was nobody there. I shuffled around, making a noise as if I wanted to buy something, and in a little while a man came in — in his shirt sleeves, dirty, and with three days' growth on his chin — and inquired what I wanted. He turned out to be the proprietor. Later his wife came in (I presume it was his wife), leaned on the counter, and joined in the conversation. I don't say that this is typical, but it is an example of some we have in Toronto. I am perfectly satisfied that it does not matter how much we try to educate the public to go to our electric stores and buy equipment — they will not go back to a store like that the second time. They will go out of that store convinced that electrical equipment is not the kind of thing they want in their homes at all. (Applause).

President:—We appreciate Dr. Carr's remarks and I am sure also that Dr. Carr might take back with him the feeling that this Association, after a good deal of consideration and thought, went sincerely into the Electrical Council, of which Dr. Carr is Chairman, with the expectation that it would do its share of co-operating with all the other industries. I think there is no doubt that while these things take time, the future will develop material benefits to the industry by this co-operation.

We have in this Association, gentlemen, one 1st Vice-President, one 2nd Vice-President, and one 3rd Vice-President. I think these Vice-Presidents should also get up and let the Association see them once at year at any rate, and I am going to ask Mr. Pratt if he will speak for a few moments. We have not had the opportunity of seeing Mr. Pratt very often in Montreal, although he comes up there occasionally. However, he is here to-day, and we will be glad to hear from him.

L. W. Pratt:—I did not expect to have the honour of addressing you this morning. I see by the programme that I am to have an opportunity of officiating this afternoon.

In making the appointment of Chairman of the Commercial section, it was felt necessary that the Province of Ontario should be tied in — to the Association — in that manner. I feel more or less on the outside among you gentlemen from Eastern Canada. In Hamilton we are in a position of splendid isolation — a little privately owned oasis in a vast morass of public ownership. (Laughter).

I had the privilege of attending the meeting of the C. E. Council (so named by Dr. Carr) a few months ago, and we had the pleasure of meeting representatives of the A. M. E. U., and I can back up Dr. Carr in what he says as to the desire on the part of the members of that Association to co-operate with us. I think one of the reasons which Dr. Carr did not touch on which led to that Association continuing to hold their Convention in Niagara Falls was the fact that this year Niagara Falls is particularly interesting to the members of that Association. They are now generating power. Most of the members who attend that Convention are Superintendents and Operators of small plants, whose zone lies within reasonable distance of Niagara

Falls. Many of them are required to pay their own expenses, and a trip to Ottawa is almost outside of the bounds of possibility for a great number of them.

There is no doubt that the contractor-dealer is the weak spot in a combined association for any co-operative movement in the electrical industry. We have found that out to our sorrow in Hamilton. In carrying out the work of electrical development, we have accomplished a great deal in spite of the fact that we have only had half-hearted support on the part of the contractor-dealers. The central stations, engineers, manufacturers and jobbers back us up splendidly, but the contractor-dealer could not see where he was going to benefit by coming in.

We embarked on a newspaper campaign, on the use of electrical appliances, and brought our campaign to a most successful conclusion. I am passing about some photographs, to show what we accomplished in that direction. In twelve days, 19,860 people saw the electric home which was thrown open to the public in the City of Hamilton. It created a great deal of comment, and was visited by all classes of the community. No one thing that has ever been tried in our City has created more interest, or been brought home more energetically than this electrical home. I strongly recommend to all the members of the Association that if they live in towns or cities where the electric home has not been put on, to think it over seriously. I was in conversation with a contractor-dealer a few days after the close of the home, and he assured me that in two days he had received $300 worth of wiring. Over fifty ranges have been sold in Hamilton since the close of the home, about three weeks ago.

As Chairman of the Membership Committee of the C. E. Council, I must confess that the problem of bringing the contractor-dealers into our Association, or to induce them to work with us (if only in an advisory way) is one that I cannot, at the present time, see any solution for, but I have associated with some men in the industry who, I think, will be able to bring in a certain amount of thought on the matter, and we hope before the next Executive meetings of the Canadian Electrical Association to be able to give a constructive report which will be of some help in solving the problem.

As I said before, I was quite unprepared to speak at the present moment, and must thank you for your kind attention. (Applause)

PRESIDENT:—Mr. Doddrige, you are representing Quebec now. Will you give us a few words? (Applause)

A. P. DODDRIDGE:—I doubt if I can say very much of interest to the members, except that I went through a very strenuous session ten days ago with the Canadian Electric Railway Association. I don't think that I have ever attended a Convention of the electrical industry that was so ably carried out. While I was not exactly a member of the Committee, my chief occupation was taking trips down town occasionally with outside members desiring to stock up a bit with something that seemed to be the prime mover. However, they seemed to enjoy them-

selves, and I may say that they were particularly impressed with the manner in which our Railway Superintendent had decorated the booths of those who were exhibiting. They were very artistically arranged indeed. The layout of the booths and the band in attendance morning and afternoon made the exhibits both of benefit and attraction, without detracting from the attendance at the meetings. The delegates were always together, and from the expressions of some of the members, they had certainly derived more benefit and enjoyed the Convention more than anything they had ever attended. The many letters which our General Manager has received from the different members tell of their deep appreciation, and of the enjoyment they had at this Convention, to which the exhibits have materially contributed.

I had the pleasure of attending one of the meetings, with Dr. Carr, together with Mr. Pratt, at Toronto. I feel sure from the impression of the members present at the time, that they would have been with us, but evidently, as Dr. Carr so ably put it, they probably thought better of it for this year. Certainly the different members present expressed themselves that they thought a joint convention was desirable, and I have no doubt in my mind that that is the solution of getting together. Common interest of the electric industry, whether municipal or otherwise, could be introduced and presented to the different bodies through a Council, and I had hopes of coming here to see the solution of our ideas in forming such a Council. (Applause)

President:—Mr. Davies, gentlemen, has worked very hard on affairs of the Canadian Electrical Association throughout the year, and as Chairman of one of the important Committees has been very active in his work. He, I know, will have a good deal to do with this Convention, but he might give us a few remarks before we pass on to our next business. (Applause).

P. T. Davies:—We have heard some reports and remarks this morning that can be discussed at this time, but before doing so I would like to say a word of praise in connection with the work of the Membership Committee. Mr. Pike presented his report in a quiet, unassuming way, so that perhaps the significance of what it contained did not quite get home. His committee has increased our membership 56 per cent.—a wonderful piece of work, and I think we should give Mr. Pike a very hearty vote of thanks for the excellent work carried on. (Applause)

I am glad to see Mr. Winter, of the Bell Telephone Co., with us. Perhaps some of us hardly appreciate the fact that the Telephone Company at one time had a strong position in the affairs of the Association. To-day they come to us more or less as an act of grace, because we do not do anything to cater to them. In London, the Institution of Electrical Engineers, which is practically the only electrical body in England, has a very large telephone and telegraph section. Some of the most abstruse calculations seem to be presented by the telephone people. I am sure some of our reports would be graced by some of these calculations if we

could only get them to work for us. It seems to me that it would be good to extend our association activities along this line. I would ask Mr. Winter whether he feels the Association could enter some of their problems, use some of their men and brains, along with the brains we have in our own organizations, to do some work for the telephone company and ourselves. We all have our own telephone systems, and we could no doubt get some good out of a telephone section, that is, if the Telephone Company feel that there is room for them in our Association. I would like to ask Mr. Winter to say a few words on this later.

With regard to the Seal Committee, that Committee was formed for the purpose of lengthening the seal period from its present six years to ten years. Mr. Vinet in his report, I think, was pessimistic about what we had done. We did not suffer a turndown in any sense of the word. We prepared the petition, came together in common with the municipally-owned utilities, who backed us up in fine shape and in every way, and saw the Minister. The Minister's reply was, he was sympathetic and would look into it, but at the first session they did not want to produce any contentious legislation at all. He said at next session, if the thing had developed to a point where they were satisfied with our claims, that they would go on with the necessary legislation. I do not look upon it as a turndown in any sense of the word, but that the Department wanted time to look into it.

The contractor-dealers have been spoken of, and I feel sorry for them. Our Merchandise Committee, I think, in their report refer to one very important feature, and that is, that up to date we have not got to the stage where the contractor-dealer can live comfortably. It seems to be a matter of spread. There is not enough spread for the contractor-dealer to make a decent living, which is a problem we, as an association, have to consider. The manufacturer will no doubt say there is plenty of room. To-day we have no rich contractor-dealers, and very few well off. The contractor-dealer is in a very much lower class than plumber or anybody else. He has to carry a big stock. If necessary, we must get after the manufacturers strongly, and make them state their case. They are as much interested in the whole chain being successful as anyone is. We are in the merchandise business ourselves, and we know it is very hard work to break even. Things have to be going very well for us to break even, and we have practically a monopoly in the towns where we do business.

I am sure the efforts of Mr. Dion and the others of the Entertainment Committee will be very much appreciated by the visitors from out of town. (Applause)

A. A. Dion:—Mr. Chairman, I am obliged to leave in a few minutes, unfortunately, to attend a meeting of the directors of our Company. It will not hold me very long, and I will soon be back again. I would like before this session closes to say a word about the reports that have just been read. I think they are most excellent reports, which reflect a great deal of credit upon the Committees.

There is an important thing that has been read this morning by Mr. Woodyatt in his report on Public Relations, that is the question of placing your stock with your power users. The N.E.L.A. is carrying on a campaign in this direction, and is working hard with the belief that this is the solution of most of the troubles of the public utility companies. Mr. Gilchrist, of Chicago, made a very fine address before the North Western Electrical Convention. It is a very excellent address, well worth reading. There are some Companies that I know of that would like to take advantage of this advice, but whose dividends are so small they feel they cannot get anybody to look at their stock, but they are not all so situated, and Companies that have a stock which is attractive ought to make efforts to place it with their customers. I think this is something we ought to think over seriously, because there is nothing that will conduce to good will of the public towards the Company better than this. I don't think this point should be passed in silence, but we should emphasize it and think it over. (Applause)

President:—There is one thing that should be attended to at this morning's meeting. We should appoint a Nominating Committee to bring in nominations for the Executive Committee and officers for next year. I am open to receive any nominations that may be made. Any suggestions for a Nominating Committee?

P. T. Davies:—I beg to propose the following gentlemen, to be named on the Nominating Committee: A. A. Dion. A. Monroe Grier, R. J. Beaumont, C. P. Barnes and W. O'Brien. I think that is the number.

President:—You have heard Mr. Davies' suggestion. All in favour? (Carried unanimously)

A. Monroe Grier:—May I say one word? Sometimes some of those named on the Nominating Committee have felt delicate about nominating themselves for office. I think it should be distinctly understood that they should not feel any sort of delicacy whatever in this direction. I say this most directly with regard to our friend, Mr. Dion, who is probably the best man we could get on the Nominating Committee, and we do not desire to be deprived of his services in any other direction.

President:—You have heard these names. Are you ready to vote? All in favour of the Nominating Committee? Any opposed? Carried unanimously.

A. Monroe Grier:—I have been asked to fill up a gap in the President's absence. It is proposed at a meeting later on in the session of this Convention to bring forward certain resolutions. Notice of these resolutions should be given. I will ask Mr. Woodyatt if he will be good enough to read the notice:

J. B. Woodyatt:—At Executive Session to be held Saturday morning, the following resolutions should be adopted:

1. A resolution approving the Letters Patent of the Association.

2. A resolution transferring all of the cash on hand, accounts receivable and assets of the old Association to the incorporated Assoc-

iation in consideration of the incorporated Association's assumption of the liabilities of the unincorporated Association.

3. A resolution declaring the old Association to be wound up and to cease to exist.

A. MONROE GRIER:—Please take notice of the fact that these things are to be proposed later.

Mr. Smith has been called outside for a minute or two. The meeting will be closed shortly, when there will be opportunity to look at the exhibits. I am asked by the Secretary to remind you that there are some delegates still to buy the book of tickets, and that a photograph will be taken later.

P. T. DAVIES:—Mr. Grier, I believe we could get Mr. Winter to say a few things about the Telephone Company. Mr. Winter, are you prepared?

W. H. WINTER:—Mr. President, on Mr. Davies' question, in 1920 there was a meeting called at Winnipeg of the different telephone systems of Canada, and a convention of Canadian telephone systems was organized. The first annual Convention was held in Vancouver last August. I was fortunate enough to be one of the delegates representing the Bell Telephone Company of Canada; and the second convention of the telephone systems of Canada will be held in Montreal at which will be represented the B. C. Telephone Company, Alberta Government Systems, Saskatchewan Government Systems, the Manitoba Government Systems, the New Brunswick Telephone Company, The Bell Telephone Company of Canada, the Maritime Telegraph and Telephone Co., and also the Temiskaming & Northern Ontario Company. This goes to show that the telephone companies are trying to get together in the same manner as the Canadian Electric Association is trying to get the power and lighting companies together.

I would suggest an invitation should be given to the telephone systems to take an active part in the Canadian Electrical Association. They apparently have been left out very largely in a lot of the different activities of the Canadian Electrical Association in which they are deeply interested, and I am sure you would find they would be a real help to the Association if the intention is to inaugurate provincial branches, or whatever you may call them, throughout the breadth of the country.

Mr. Davies suggested that our Company take a more active part in the Association; I believe from a technical point of view we have a number of very well versed engineers in our Company, and there is no doubt but what the Company would approve of our Association taking a more active part in the Association. I feel that I can assure the Association that if our technical men can be of any benefit at any time to the Association, or to any of the companies members of the Electric Association, in that line, it will be only too pleased to assist in any manner possible. (Applause)

PRESIDENT:—One of the serious problems that looms in front of us in the years to come is going to be this question of the relation of the

communication companies to the power companies. There is absolutely no doubt in our mind that our industry is bound to grow by the creation of trunk lines, and by a greatly increased amount of power which will be transmitted. This is bound to result in trouble with the telephone and telegraph companies if it is not guarded against, and in many places, as you know, serious difficulties have arisen, and many disputes, and in some cases litigation, have created bad feeling between the telephone, telegraph and power interests. Here in Canada we have been much more fortunate, partly due to the personalities of Mr. Winter and his friends, who have always met the power people in a friendly frame of mind, and have always disposed of these questions as they come up. It seems to me, however, that it would be very much better if this Association could be made up to a much larger extent, as it used to be years ago, of men who are interested in the telegraph, and particularly the telephone companies, because after all one of the objects of these conventions is to get men together who are apt to fight in the ordinary course of their duties, and if they get together and discuss and see the different phases of these problems, they are very much more apt to work out amicable solutions.

So I think this should be passed on to the next Executive Committee as an important phase of the work, and every effort should be made to bring in a large number of men interested in the telephone and telegraph companies.

Now, gentlemen, I want to remind you that at 12.35 on the terrace, in front of the hotel, a group photograph is to be taken; we want you all to be there, and to bring your wives and guests.

The meeting is adjourned.

SECRETARY:—Luncheon will be held in the banquet room upstairs.

AFTERNOON SESSION, THURSDAY, JUNE 15.

PRESIDENT:—We will resume our labours now. The first report on this afternoon's programme is by Mr. Pratt — Report of the Commercial Section.

L. W. PRATT:—Mr. Chairman and gentlemen. It would ill become me to take credit for the results in the Commercial Section. While it is true I have been Chairman for the past year, I feel the results are entirely due to members of my Committee in their loyal co-operation and thorough painstaking effort in making the programme of the Commercial Section the success which I am sure is offered by the programme which you see before you. In having assigned to us the primary position on the programme of the afternoon meeting of the first day, I feel that the thanks of the Committee is due to Mr. Vinet and Mr. Smith for giving us this opportunity, and will try to return the compliment with the results, which we shall give.

We make no apology for our subject — Power, — the force which drives the roaring loom of time — Light, the only thing which separates this world from chaos — Merchandise, — a transaction immortalized by our first parent, by a little transaction in apples.

REPORT OF COMMERCIAL SECTION—1922.

Your Committee representing the Commercial Section have pleasure in submitting report, as follows:

1. Power Sales Bureau, under the chairmanship of Mr. P. R. Labelle.
2. Merchandise Sales Bureau, in charge of Mr. G. R. Atchison.
3. Lighting Sales Bureau, under Mr. J. H. O'Hara.

Mr. C. T. Barnes representing the Commercial Section on our Committee on Commercial Service and Relations with Customers.

It is to be regretted that owing to the necessity of re-organizing the Commercial Section due to the resignation of the original nominee for the position of Chairman, that your Committee was unable to get under way until about the first of October, with the result that we were not represented at the first two meetings of the Executive Committee of the N.E.L.A. Commercial Section. Had this been possible, our work would have been tied in with that of the N.E.L.A. It was thought desirable, inasmuch as your Chairman was located so far from the headquarters of the Association, to limit the number of bureaus to three.

POWER SALES BUREAU

In connection with the report of the Power Sales Bureau, there are two points in this report worthy of special attention:

1st. The power factor clause which is too often neglected in many contracts. Attention is called to an article on the subject of power factor on page 311 of the May, 1922, issue of the N.E.L.A. Bulletin. It is generally conceded that the Customers' maximum kilovolt ampere demand should govern the demand charge.

2nd. The desirability of all power companies adopting a standard basis of sales and measurements of power.

LIGHTING SALES BUREAU

Your Committee feel that rather than attempt to cover the many different phases of activity that might be classed under "Lighting Sales," it would be better to present a full report upon one particular branch of the work. Industrial Lighting was selected as promising the best results for a report of this kind, and in the following report we have endeavored to present some real information that will be of practical value to the ordinary Central Station Salesman.

No new development in lamps has come to our notice during the past year. Efforts seem to have been concentrated on shades and reflectors. The latest types are fully dealt with in the report.

It is earnestly hoped that this paper will not merely be taken as read, but that thoughtful consideration be given to the many valuable suggestions made.

The Commercial Lighting Branch of our business is coming into its own again. During the past few years, lighting service in many parts

of Canada has been so low in price and lamps so efficient that little attention was given by the public to efficiencies. With the increasing competition of the past year or two however, a renewed demand for the best possible service has been created and lighting salesmen will be expected to give practical and reliable advice to their Customers.

MERCHANDISE SALES BUREAU

While the convenience of electrical appliances is beyond question, and the cost of operating them in Ontario at least is almost negligible, the desirability of stimulating their sale by every possible means is at once apparent, when upon reflection we find that in spite of the constantly increasing cost of production, the price of electrical energy has been steadily falling, due to the filling up of the valleys in the load curve by the appliance load.

Respectfully submitted,
P. R. LABELLE,
J. H. O'HARA,
G. R. ATCHISON,
C. T. BARNES,
L. W. PRATT, *Chairman.*

REPORT OF POWER SALES BUREAU

Your Power Sales Bureau begs to report that during the past year, owing to the general depression throughout the country, the demand for power for new industries had been very limited.

During the current year this Bureau thought it advisable to try and standardize Power Contracts for general use throughout the country, and after obtaining copies of Power Contracts from various member companies, it was considered advisable, owing to different conditions in the different sections of the country, not to attempt to draw up a standard form of Power Contract, but this Bureau desires to draw the attention of member companies, in particular to smaller companies, to the necessity of providing in their contract for the following:—

1st—*Power factor clause.*—The larger companies already provide against loads with poor power factor realizing the importance of this, but the smaller companies, we find, are overlooking this all-important matter.

2nd—All power contracts should have a minimum guaranteed monthly payment to provide against loss of revenue during shut-down. During the past few years a number of member companies have suffered considerably having no provision in their contract to protect themselves against this loss of revenue, and this particularly applies to smaller companies.

All contracts should have a clause stating that the maintenance of voltage and frequency at the point of delivery shall constitute delivery of service.

3rd.—A definition should be made on all Power Contracts of the basis for the measurement of the power contracted for. A reasonable basis for fair sized loads seem to be a 10 to 15 minute average maximum load; smaller loads can be well taken care of by basing a rate on the size of the motor as designated by the name plate.

In discussing power prices and conditions with prospective customers, reference is frequently made to conditions offered by competitive companies, and it would seem that if all companies adopted a standard basis of measurement that it would be to the benefit of all.

During the current year, this Bureau circularized all the member companies drawing their attention to the Electrical Heating courses given by the N.E.L.A. These courses have been given both at the works of the Westinghouse Company and the General Electric Company, and from information received from those who have taken these courses, and from the personal knowledge of the Chairman of your Bureau, who had the privilege of taking this course, central stations are strongly recommended to send representatives to attend these courses as they are certainly the means of putting one in touch with the various applications of Electrical Heating, and give one a proper view of the possibilities for this class of business. I believe it is the intention of the N.E.L.A. to make arrangements to continue these courses throughout the year.

This question of Industrial Heating is a very important one to all distribution companies, as being an excellent means of providing additional load. It would seem, however, that before recommending the application of electricity for heating purposes, that a very close survey of conditions be made so as to not saddle the customer with apparatus which would not be economical, and thereby avoid dissatisfaction and the condemnation of electrical apparatus for this purpose.

Considerable publicity has been given to electric furnaces for the melting of brass and other metals, but it would seem from the experience of several companies that, before recommending apparatus of this kind, serious consideration should be given to the matter, as unless these furnaces can be used at a fairly high load factor, instead of being a benefit to the customer, they become a burden, owing to the minimum payments which are always provided for in contracts of this kind.

The electric range load and bake oven load is one that is well worthy of being developed, and owing to the diversity factor of these loads, it is productive of a very good revenue to the companies. Serious effort should be made to promote the use of various appliances in the home.

A careful study and survey made by a company in Philadelphia on some 1,300 houses using various apparatus shows that 51 1/10 per cent of the total energy consumed was used from 7 a.m. to 7 p.m., showing that this was entirely used by household appliances, and 49 1/10 per cent. was consumed from 7 p.m. to 7 a.m., showing distinctly that the appliance load is equal to the lighting load. This study was made in the summer months, at which time the lighting load does not cross the load or energy

used by appliances. This survey was carried on for one whole week, and certainly shows up very plainly the importance of the use of appliances as a revenue producer.

During the current year a sub-committee was formed to make a study of the handling of material in large industrial plants, freight yards, railway terminals and docks, but owing to the very late date at which this committee was formed, they have been unable to collect sufficient data to make a report. We presume, however, that this committee will be continued for the next year, and that they will be able to present some very interesting data in connection with these matters.

Other Committees of the Association such as meter committee, rural lines committees, etc., we understand, are presenting reports dealing with some of the power problems, and as discussion will undoubtedly be made on this subject, it is not considered necessary to deal with these matters in our report.

(*Signed*) P. T. DAVIES
B. M. GALL
A. P. DODDRIDGE
P. R. LABELLE, *Chairman.*

L. W. PRATT:—I would like to ask Mr. Labelle to give a resume of paper which no doubt you have all read, and if possible to mention his experience in connection with the industrial heating course which he attended on the other side a few months ago. (Applause)

P. R. LABELLE:—With reference to the Industrial Heating course, the N.E.L.A. realized that besides the matter of lighting and motive power, there was a large field for industrial heating. They got together with the Westinghouse and General Electric Companies and the latter named Companies agreed to give a course of Industrial Heating. It was the original intention to have the courses consist of two weeks at the General Electric Works and a further two weeks at the Works of the Westinghouse Co., but realizing that this would undoubtedly work a hardship on the different companies by having their men absent for a whole month, it was decided to divide up the courses and give a two weeks' course at each of the different Works. One week's work of this course consisted of lectures at the Works of these different Companies and visits through their factories, and the following week consisted of visiting installations in different towns so as to get the viewpoint of the different manufacturers and also see actual operations in the field. The courses consisted of lectures by the different engineers of the Companies. In the course which I followed at Schenectady, we spent one whole week there and then one week in the field. The talks were on the following subjects:—

Electric Welding.

Non-ferrous Melting Furnaces.

History of Industrial Electric Heating and future possibilities.

Principles of electric heating and temperature ranges covered.

Small devices and their various uses such as glue pots, space heaters, etc.

Design and construction of small devices.

Industrial ovens and methods of calculating requirements.

Design and construction of industrial heaters.

Design control for industrial ovens.

Furnaces for heat treating metals, vitreous enamelling, etc.

The last week consisted of visits to different towns. Spent one day in Springfield where we visited the plant of Chapman Valve Co., who have an installation consisting of core ovens, electric furnaces for brass and steel and heat treating ovens. One day spent in Hartford where we had the opportunity of going through the factories of the Gray Telephone Co., manufacturing telephone boxes; the Royal Typewriter Works, The New Departure Mfg. Co. and the Johns-Pratt Co., etc. In these various factories we had the opportunity of seeing in operation japanning ovens, enamelling ovens and different heat treating furnaces. We also spent one day in Rochester where we visited the factory of the Eastman Kodak Co., The Ritter Dental Co., Galusha Stove Co. and the Gleason Works.

The Gleason Works, manufacturers of gears, have a heat treating furnace, one of their furnaces being one designed specially with 14 different speed controls.

The Eastman Kodak Co. have very large japanning ovens and enamelling ovens.

In Buffalo we visited the Ford Motor Works where they have large japanning ovens, and also the Works of the Fowler and Union Horse Nail Co. who have furnaces for treatment of wire.

In our visit to these different factories we had the opportunity of getting in touch with the different managers and superintendents of the plants and ascertaining from them the advantages derived from electric heating. In some cases, electric heating was considerably more expensive than gas, oil, etc., still on the other hand the advantages derived by having absolute control of their heat more than offset the cost of the power. There is no doubt that there is a vast field for this industrial heating and you will find that such Companies as the Westinghouse and General Electric, together with the manufacturers of ovens, furnaces and appliances, are quite willing to co-operate with us in any way and give us the full benefit of their knowledge. In the United States where they have a much vaster field than we have, they are much further advanced, as we are practically just scratching the surface in this class of business.

PRESIDENT:—Mr. R. J. Beaumont, of the Shawinigan Company. Will you start discussion on this important paper?

R. J. BEAUMONT:—In connection with the report of the Power Sales Bureau introduced by the Chairman, Mr. Labelle, I would like to say a few remarks apropos the subject of power sales, but not specifically mentioned in his report.

In the Province of Quebec we have coming up continually the question of electric heating of houses, and as you are all very familiar with the practical impossibility of a satisfactory solution of this problem, we have considerable difficulty in persuading our prospective customers that we are not actuated by some ulterior motive when we tell them that the scheme is an impractical one. To meet this ever present problem we found it necessary to prepare a few articles which we occasionally insert in both the French and English press, and also use to circularize individuals.

The Government some three or four years ago printed an article, which was prepared by Mr. Barnes, of the Hydro Electric Commission, showing that this scheme was not feasible, but this article is now in many respects out of date, and I would suggest to the incoming Power Sales Committee that they prepare a pamphlet which will answer this question. In this way the statements will be uniform in every respect and I think we can make a much better case than possibly made by Mr. Barnes.

Another matter which I would like to mention in passing is that, in my opinion, in connection with the selling of power, flat rates should, to a large extent, be discarded and a condition finally looked forward to so that we might bring about a condition which may be expressed as "every K. W. Hour should have its price."

Another matter I notice, there is mention in the report of suggesting a uniform method of measurement of power. This is, of course, a very good thing, and I do not think there is any question that this means that power should be sold on what is popularly known as a combined rate, this consisting of a fixed charge which is the minimum charge under the contract, with three or more sliding scale steps as may be found necessary. A statement of the standardization of these steps might be included with advantage in the next year's work of this Committee.

(Applause)

PRESIDENT:—Gentlemen, I am sure we have some further discussion on this important subject.

J. B. WOODYATT:—In Mr. Labelle's report, he stated that after considering copies of power contracts from various member companies, it was considered advisable, owing to conditions in different sections, not to attempt to draw up a standard form of power contract. I think it will be interesting to discuss that, because I cannot see why some of the different conditions cannot be adopted so that we can have a standard form of power contract. I imagine that in the old days every railroad had a different form of bill of lading, but finally they drew up a standard form of bill of lading for all the railroads, whether publicly or privately owned, whether in Canada or the United States. I think, particularly with reference to the technical clauses, that we should have standard clauses that would apply throughout the country, and then others could be added in the case of privately or publicly owned utilities. I think it would be worth while to have some discussion regarding

these conditions that seem to prevent the drawing up of a standard contract, to see if we cannot go ahead with that this year.

There is another item in connection with the definition of power. It is suggested ten or fifteen minutes for the average maximum load. I am not so much interested as to whether it should be ten or fifteen minutes, but I am interested in arriving at a definition of power. We sell power for so much per horsepower, but the price might vary 100 per cent. or even more according to the definition of a horsepower. Surely we can arrive at some proper definition of the unit of what we are selling. I think it would be well for us to discuss it here, or for the succeeding committee to carry on this work.

One other point came up. Mr. Beaumont suggested that we ought not to have flat rates in selling power and stick to the KWH only. I cannot quite see that. Perhaps a little discussion on this will be illuminating. I think that, particularly in selling electric power, such a great percentage of our cost is fixed that it would be a mistake to drift entirely into selling our power on a straight kilowatt hour basis.

President:—I do not believe that was the suggestion. The suggestion was, that there should be a mixed rate.

J. B. Woodyatt:—I think the demand charge should be the greatest factor in the rate. The meter rates should be sufficient to keep customer off the lines when the power was not required so as to increase the diversity.

President:—Mr. Woodyatt has raised a matter which seems to be important — that endeavours should be made by this Association towards a form of standard power contract. There are a great many advantages to be gained, and I think perhaps the disadvantages will get less as this matter is studied. I am sure it is going to take time to develop such a scheme, but I think this idea is one we might profitably discuss a little while, and perhaps we can pass this along in such shape that we can actually get forward with it during the next year.

Mr. O'Brien, you represent a very large power sales division, the Montreal Light, Heat & Power Co. What do you think of an idea of trying to have a uniform power contract throughout the whole Dominion of Canada?

W. O'Brien:—I have been discussing this subject with some members of the Committee. It appears to be a good idea, I do not know of any reason why it cannot be carried through, and the general contract conditions for power service made alike for adoption throughout the country. If necessary, special conditions may be inserted to cover special arrangements in the supply of power service as warranted in any locality and for any particular service.

Mr. Labelle has mentioned something in reference to the inclusion in power contracts of a provision protecting the Companies against reduction of a consumer's maximum demand and covering payment by consumer for service during a prolonged shutdown. Some companies already have such provision, we (M.L.H. & P. Cons.) have it in our

contracts to the effect that the maximum demand once established shall constitute the billing basis unless and until exceeded. The matter of standardizing contract conditions, I would say, should be taken up by next year's Committee.

I would ask Mr. Labelle regarding service for electric welding and industrial heating. Was the subject of rates for such service taken up at any time during the period of the course which he attended, also what sort of a demand does such service create on a system and its characteristics? The load factor, in some applications, I understand is high — Are there any suggestions or proposals in regard to rates to be applied, whether fixed charge based on demand plus meter rate or straight line meter rate with minimum guarantee is favored?

P. R. LABELLE:—Question of rates was not discussed, but I do find in copies of contracts that same make special provision for the arc welding installation. This service creates a very heavy demand. I have not got anything with me as to what the conditions are, but will be pleased to put you in touch with same.

W. O'BRIEN:—We are all aware of it and run up against it often. Our contract conditions are sometimes subject to strong criticism by the public, they compare us very frequently with the railways in respect to the bill of lading and will make the claim that contract conditions favor the supply company and are against the power consumer. However, speaking for our own contract, if gone through clause for clause with the consumer with proper explanations, at the end he has very little criticism to offer. A contract with standard conditions would help to allay suspicion on the part of the consumer. On the whole I should think this a subject for close consideration by the succeeding Power Sales Committee.

PRESIDENT:—Mr. Doddridge, do you think we could get a uniform contract to satisfy different power companies?

A. P. DODDRIDGE:—Well, I do not know, but it seems to me that the form of contract got up by Mr. Labelle is very much of a form contract at present. I think all the larger companies' clauses are pretty much the same. I went through it very carefully, comparing it to our own and to others, and there is not very much difference. I think it could be embodied in a form contract.

L. W. PRATT:—I may say that while the members of the Committee agreed pretty well on the terms of a standard contract, the difficulty seems to be that it would have to go to the Executives of the various companies to be finally passed upon. Many of these contracts are passed on by legal authorities.

P. R. LABELLE:—All our forms of contract are passed upon by our legal advisers and no changes in our standard form will be made unless submitted to them.

A. A. DION:—Mr. Chairman, I have not very much to say on this subject. Referring to the Chairman's remark, that the first transaction in merchandising was performed by Adam, it strikes me that it wasn't a

very profitable operation. I trust that our merchandising will be more profitable. Indeed, I think that it ought to be profitable. I am one of those who believe that our merchandising should not only carry itself, but should be a source of some profit to the Company. In our experience we find that the expansion of the business has not been affected at all by the slightly higher prices for the appliances which are necessary to give the Company a profit. Besides, in doing this. you are protecting contractor-dealers in the City who are helping to increase your business. I am very firmly of the opinion that this is the proper course to follow.

Under the head of "Illumination": I agree with the suggestion that there is a great deal to be done in improving illumination, and it must be done by the companies. There is very little being done outside of the companies, in advising customers as to the proper way of using illumination. I am referring specially to store and window illumination. A great deal can be done to improve the condition of show windows and stores, and it must come from the companies. The smaller companies cannot employ men who are trained in this line, but at the same time it isn't a very difficult thing to talk to the salesmen and get them to acquire sufficient information on the subject to be of great use to their company in that respect.

Referring to house heating. Here, where rates are very low, we have been confronted with applications for house heating which we have to turn down, necessarily. In some cases it has been proposed to use a system of heating with storage feature—heating apparatus which would store energy so that it could be shut down for five or six hours per day, using stored energy during that time. This has been found impracticable in most cases, because we have not to-day very deep load valleys that we are anxious to fill during the day, and for that reason you cannot quote rates for that sort of work which are attractive to the customer.

I would like to know from members present whether it is the practice of any company to give inducements for the installation of synchronous apparatus instead of, for instance, induction motors — whether any rebates are made to encourage customers to buy this type of apparatus.

I don't know that I have anything to say regarding the form of contract. I think uniform contracts would be of use in disputes with customers. It could be pointed out that this is the accepted standard practice, and would help you to convince your customer that your contract is a fair one.

PRESIDENT:—This whole subject so far as it affects power rates is rather a new one, having come up in the last three or four years. Speaking for the Shawinigan Company I might say that our practice on all large contracts exceeding 1,000 K.W., which I think is followed by other Companies in Quebec, has been this: we insist on the installation of synchronous motors unless the customer's load is made up of small units, which is not in general the case on our system, as the majority

of these loads have been made up of pulp grinding machinery, of which the units have been large. Our 60 cycle contracts call for 85 per cent. power factor. We do not bonus the customer in case it falls below that figure. This in itself compells the average customer on the 60 cycle system to put in some kind of power factor correction. I do not know of any company to-day that is paying a bonus for the installation of synchronous apparatus. I think the custom is rather to penalize the customer unless the power factor is kept up.

Mr. Woodyatt, have you any knowledge of this?

J. B. WOODYATT:—We give a discount of 5 per cent. where customer installs synchronous machinery, and permits us to control regulation of it.

PRESIDENT:—I might say that under these large contracts we do not only ask for 85 per cent. power factor, but if the amount of power involved runs up to 10,000, or 20,000 K. W. we demand that the customer install sufficient synchronous capacity to vary the power factor anywhere from 85 per cent. lagging to 90 per cent. leading. This holds up the regulation of the customer's line. Of course you cannot do this on small installations, but it is quite possible on big ones. Manufacturers have improved synchronous apparatus, and we are going to see much more of it installed and in larger units. Is there any further discussion on this question?

L. W. PRATT:—I might say that in certain large power contracts of ours, we fixed the nominal power factor at 70 per cent. If the customer's power factor falls below that, we penalize him 1 per cent. for every per cent. of power factor below 70. But if the power factor is above 70 per cent. we give him bonus or discount of half of 1 per cent.

PRESIDENT:—If he went on up to 50 per cent leading, would you continue to bonus him ?

L. W. PRATT:—While I believe our contracts do not specifically cover that point, I believe it would be a hard matter to get anything for leading power factor. In our case power factor it is not a great matter with us, as we have a large steam plant which is on the line most of the time, and we perform most of our own correction.

R. J. BEAUMONT:—Would say in this power factor matter, a new development applies with some customers in Montreal. They have purchased static power factor correctors for very small units. These have not been installed yet, but that will be a new problem for central stations.

Would like to say something with reference to Mr. Woodyatt's remark. I think he misunderstood me. I think every kilowatt hour should have its price. It is my idea that the fixed charge should be possibly the main charge, but in range of 20 per cent. below factor to 29 per cent. above, perhaps difference in cost would be 10 per cent., so that price of power would be very small, but the main thing is to have charge for every kilowatt used.

MR. BROWN:—The majority of large consumers in Montreal have corrected power factor, and get good results.

Don't you think that it falls on the shoulders of the contractor-dealer, as well as the power company to help in the work of commercial illumination? The consumer is likely to regard the power company as having an axe to grind. It is really their job to increase their business, and work with the power company in this direction.

A. A. DION:—There is no doubt that the contractor can do more than the Company, because he comes in contact with the consumer, but unfortunately he does not do it, or do it well. It is a case of educating the contractor-dealer, and I am safe in saying that we are getting to that point. It is a case of showing them what they are up against. A few years ago they were unorganized. Now these contractor-dealers have got together and are most enthusiastic, and see the point they should have seen long ago. I don't think it will be long before they get better at it. I think the thing to be done is the education of the contractor-dealer. They can help more than anybody else.

PRESIDENT:—Now, gentlemen, if the discussion on that subject is finished, we will listen to Mr. Geo. Atchison's report on Merchandising.

REPORT OF MERCHANDISE SALES BUREAU—1922

During the past year we have gone through a rather strenuous period in the sale of Electrical Merchandise, due to the unsettled conditions which have affected the country throughout. Conditions would now appear, however, to indicate that we have "turned corner," and that we may look for a general improvement in business. This may not develop as rapidly as might be wished for, but it will have the virtue of tending to a more substantial and steady growth. Unemployment is decreasing, labor conditions are more settled, and the dollar is climbing back to its real value. We should, therefore, be able to view the future of the sale of Electrical Merchandise, which offers vast possibilities with much optimism.

Our main problem seems to be that of "Selling the Idea," and creating the desire for Electrical Labor Saving Appliances, and other merchandise. We have made quite substantial progress along these lines, but still have a great deal of hard work ahead, as many people are yet practically ignorant of what the use of Electrical Appliances and other merchandise means, both commercially and in the home.

There are several different methods by which this can be carried out; all of which help considerably in educating the public to the need for Electrical Merchandise; of these, newspaper advertising plays no small part, if properly handled; a co-operative campaign of newspaper advertising by the different electrical interests throughout the country would

be of great benefit. A campaign along somewhat similar lines is now being conducted in the United States by the Vacuum Cleaner Manufacturers.

Store demonstrations, exhibits at the many Fairs conducted in all parts of the country, installations in Domestic Science Schools, are also very good mediums of education.

Generally speaking, at present, we have very few items of Electrical Merchandise which can be classed as "over the counter merchandise". Our problem is, therefore, to educate the public to the need of our merchandise, and we will then have a different state of affairs than now exist. We can then reasonably expect the public to come to our Stores to purchase our merchandise, as they now do in many lines, such as hardware, furniture, etc.

In recognizing this fact it naturally follows that the selling expenses from a retail standpoint must necessarily be very high, as many of our appliances must be sold on a "specialty" basis, such as cash registers and adding machines. The average cost of doing business in the merchandising of Electrical Appliances and supplies is approximately 26 per cent. on the selling price.

The figure may appear high, but it can be largely accounted for by the high selling expense involved; a figure of 10 per cent. as a minimum being approximately the amount paid to the salesmen as their compensation, leaving only 16 per cent. to take care of expense involved in demonstration of appliances in customers' homes, which is practically a necessity to secure the sale, and such expenses as delivery, rent, light, heat, interest, taxes, together with the return which should naturally be expected on the capital invested.

It is a more or less recognized fact that at present the Electrical Merchandising field does not offer a very attractive return on the capital invested, on account of the high cost of doing business, compared to the prices received for our commodities, many of which prices, particularly in the case of appliances and featured articles, are being set by the manufacturers. This obviously would appear to be a very important question for the manufacturers, jobbers, contractor-dealers and central stations to get together on, and determine the conditions under which an improvement can be effected.

Additional capital would then be attracted which would result in the growth being stimulated, which would prove of great benefit to all in the industry, as our business to a large extent is on the basis of "what helps one helps all."

In this connection it is quite gratifying to note many co-operative associations being organized throughout the country and through which we may hope to solve many of our problems through this "get together" spirit.

Sales campaigns, when properly conducted, supplemented by advertising generally, bring very good results; one of the great difficulties in conducting a campaign is to secure competent salesmen, who are suffi-

ciently familiar with our line, to get the message across and secure the business.

It might be interesting to know that one of our member companies is now conducting a sales campaign on Electric Ranges, on which terms of payment have been extended to two years, with only an initial payment of $10.00 required. A circular letter explaining the proposition as per appendix is mailed to a selected list of prospects and these are then followed up by a call from either a salesman or the agent in charge.

It is generally admitted that to sell the larger appliances in any volume, payments must be extended, a year generally being the limit. To cover accommodation 10 per cent. is added to the cash price. When appliances or other material are put on this basis a lien form should be signed by the customer stipulating that the appliance or material is the dealer's property, until final payment is made.

Where the dealer may not find it quite convenient to carry the paper involved in extended term payment sales, usually an arrangment can be made with some financial company to carry this at approximately 7 per cent., and advance the dealer the major part of the money involved in each sale, thereby enabling him to use his capital to good advantage.

Extended terms of payment have also been allowed on house wiring, with very good results. Frequently the contractor-dealer can effect an arrangement with the central station to help out not only to finance this, but to supplement the contractor-dealer's efforts by a sales campaign conducted along these lines.

The question has very frequently been raised as to whether a central station could conduct a merchandise business, but it has been proven that where this is conducted on a strictly ethical basis, it must prove of benefit to all those directly and indirectly interested. A greater demand for appliances and supplies is stimulated through the advertising and aggressive sales methods adopted by them, resulting in more business for all concerned. Where the central station has dropped out of merchandising, experience has shown that contractor-dealers instead of having more business have had a decided falling off in their business. Every central station is undoubtedly anxious and willing to co-operate in every way with the contractor-dealer, and where the same spirit is returned by the contractor dealer, results will be mutually beneficial.

In order to conduct their Merchandise Department on a strictly ethical basis, central stations should charge directly against this Department those expenses such as salaries and commissions, rent, interest, insurances, taxes, delivery, inventory adjustments, etc., which are applicable and would necessarily be incurred by any contractor-dealer.

Appliances and other supplies should be sold at list price, adopted by the manufacturers, and all other material on which there are no stipulated re-sale prices, at such prices as will cover overhead charges, and return a profit; thereby enabling the contractor-dealer to conduct his business along similar lines and eliminate any idea of unfair competition on the part of the central station.

A spirit of co-operation along these lines will do much to remove the little misunderstandings that occur, and establish that feeling of confidence which is so essential and beneficial.

If we are to develop the merchandising end of the business as we hope to, it must be conducted by all the different factions in a similar manner to that which other successful businesses have followed; viz., a recognition of the different functions of each faction, and an appreciation of the benefits which each can derive from the other.

To properly conduct an Electrical Store, a very careful watch should be kept on the purchases and sales, and an endeavor should be made to have a stock turn-over of at least four times per year. Any article which remains in stock longer than six months should be placed on sale at a reduced price, if necessary, in a prominent location in the store, and when disposed of, this class of material should not again be placed in stock.

With the small margin of discounts in effect by the different manufacturers, a quick turn-over is essential if any profit is to be realized.

In order to enhance the development of the sale of Electrical Merchandise, we should only sell such merchandise as will render satisfaction and return full value for the money invested by the consumer.

Electrical Stores should be kept neat and clean, windows carefully arranged at regular intervals, and appliances and supplies neatly displayed in such a way as to create the interest of a prospective customer. In describing appliances to the prospect, our talk should be in simple terms, avoiding the use of technical terms, which only tend to confusion.

Each store should set a definite figure as the amount of business they are endeavoring to attain for the year; this figure being based on the number of customers supplied with power and lighting service in their city or town and surrounding district. The contractor-dealer could doubtless secure this information on which to base his figures from the central station, and then set his figures for the year, figuring that each lighting or power customer is a prospect for merchandise of some kind.

ELECTRICAL COOKING.

Electric cooking is gaining very rapidly in favor and we feel that a great deal of productive work is being done along these lines, with the low cost of operation, and with the many conveniences and advantages offered, we can naturally expect to see a very rapid growth in the electric range business.

We believe that the manufacturers would be well advised to consider reducing the number of models or different styles of ranges, and in this way not only relieve some of their own burden, but also help the dealer to keep his stock down by only carrying two or three models. This might also help the manufacturers to reduce their costs, and reduce the price both to the dealer and the consumer.

The question of ease of repairs should also have the very careful consideration of the manufacturers. It is very gratifying to note that

many improvements along these lines are now being effected, and this will do a great deal towards increasing the popularity of electric cooking.

To repair an electric range has been very difficult and expensive; certain repairs taking hours to fix, resulting in an extremely high service charge to be borne, either by the central station and contractor-dealer in most cases, or by the customer where the guarantee period has expired. We would submit to the different manufacturers the question of making surface units interchangeable and easily replaced, so that in the event of any trouble with one of these units a woman could make the change herself, without having to call in a service man.

The question of water heating links up very closely with the sale of electric ranges. Several types of heaters are on the market, which are generally giving good satisfaction, but again the question of repairs enters. It is very disturbing for a customer to have a heater burn out after being in operation only one or two years, and then find that the cost of the necessary repairs is close to that of the original price of the heater.

Regarding cost of operation: different rates can be applied which will meet the required conditions, but in order to give good service and keep the cost of operation down to a minimum, every heater should be supplied with sufficient lagging for the tank and piping.

CONVENIENCE OUTLETS.

In order to encourage the easy use of appliances, every endeavor should be made to sell the consumer the necessity for convenience outlets. This will not only result in more business for the manufacturers, jobbers and contractor-dealers in supplying and installing the material for these outlets, but in making the use of the appliances more convenient will result greatly in increased revenue to the central station.

A great deal is being accomplished along these lines in the many Electric Homes which are being opened to the public, from which they are learning the necessity for adequate wiring and how Electrical Labor Saving Appliances will solve many of their housekeeper problems.

MANUFACTURERS' HELPS.

Contractor-dealers and central stations should take advantage of the many circulars, window displays and advertising helps which are offered by the manufacturers. These should be carefully handled, as they represent a very considerable amount of money on the manufacturers' part. Circulars should be carefully distributed to prospects, and where possible, these together with window displays should tie in with local newspaper advertising. In supplying circulars the manufacturers should also be prepared to supply these in French when called for. This would also apply to instruction books or cards on the care and operation of appliances.

POTENTIAL POSSIBILITIES.

We have in Canada at the present time over 700,000 users of Electric Service, many of whom when properly sold on the idea are immediate prospects for hundreds of dollars of our appliances, and all of whom are prospects for possibly smaller amounts, and in the aggregate representing many millions of dollars.

These potential possibilities can be actually realized, if we will establish among ourselves a strong spirit of co-operation and confidence.

GEO L. ATCHISON, *Chairman.*

APPENDIX

Dear Madam,— April 15, 1922.

"Eventually, why not now?" may be well applied to the purchase of an Electric Range. Electric Cooking has so many points of superiority over all other methods that we firmly believe, as these become known, no woman will be satisfied until she has an Electric Range installed in her kitchen. Cooking is an art in which all women wish to be very proficient, and the Electric Range is the means by which this can be accomplished. Some of its many advantages are:—

Scientific Methods:

Cooking more delicious, digestible and nourishing food, with assured uniform results at a minimum of time and work.

Joy of Electric Cooking:

Freedom from excessive heat, fumes, sooty utensils, handling of fuel, wearisome, worn-out methods—convenience. Obtaining any desired heat at the touch of the switch—instantly.

Cleanliness:

No smoke, soot.—No discolored walls and woodwork.—No ashes.

Saving in work:

Elimination of fuel handling—pot scouring; saving food—much less shrinkage in meats.

Safety:

No danger of fire or explosion—no need for matches.

Cost of operation:

Extremely moderate—the average monthly bill for over 1,000 of our customers being $4.00 each per month.

We want to count you among our many satisfied users of Electric Cooking; and are so confident of the very excellent results you will secure that we are prepared to make you an offer to place a range in your home on two weeks' trial. If, at the end of that time it has not accomplished all we have claimed, we will remove it without any cost to you.

If you desire, as we believe you will, to keep it, you may either pay us within thirty days, or extend payments on a monthly basis over any period up to two years, at a nominal increase over the cash price. On this latter basis, only the very small initial payment of $10.00 is called for, and further monthly payment of approximately $5.00 to $8.00, depending upon style chosen until final payment is made.

In view of an order for a large quantity of Electric Ranges, we have been able to purchase these from the manufacturers at a considerable saving, and are, therefore able to pass this benefit on to our customers in the form of very attractive prices, ranging on a cash basis from $75.00 to $135.00 with a nominal increase in these prices for extended terms of payment.

We believe you will agree with us that this is an exceptionally attractive offer, and that it is to your advantage to place your order now. We expect a very heavy demand, judging from our inquiries, and the ranges will be installed in the order in which instructions are received. The hot weather will soon be upon us, so why not place your order NOW, and enjoy all the conveniences and advantages from the start.

We will be very pleased to have one of our representatives call on you, and give any information you may desire; or we will consider it a pleasure to have you visit our store, and choose the style of range you desire.

All that is necessary for you to do, if you accept our offer, or require further information is to telephone or visit our office, or write and we are at your service.

Yours truly,
Southern Canada Power Co., Limited.
(Applause)

PRESIDENT:—Gentlemen, we have heard the repart of Mr. Atchison, and I am sure that there will be quite a bit of discussion on this important subject.

It seems to me there must be some answer to the problems that come up to the Executive of the power companies regarding these stores. Personally, I think the power company ought not to go into any business unless it goes in it on business principles. If it is going to sell merchandise, it ought to sell it as other people should sell it — to make money out of it. The real trouble no doubt in the situation is that a lot of manufacturers have not yet worked out their selling prices, so that there is a tremendous lot of price cutting and variation in the prices they name for their goods, and when this is eliminated some of the difficulties we now experience certainly will be very much relieved. I think that in this Association we should make every effort to get manufacturers and power companies together on this subject. Surely there must be some means to determine the spread between manufacturer and jobber. If they will insist that the price be maintained, and that everybody has got to pay the price, then we can determine some means by which these jobbers and stores selling merchandise can make a profit.

Speaking for our Company, we go into the business in some places, not because we want to, but because we are forced into it. Then someone else comes along in business, and it creates trouble through the other man's prices for all kinds of equipment being so different, you cannot persuade the customer that either you are not robbing him, or the other fellow is not robbing him. I think there is ground for improvement.

Mr. Pike, you are interested in this subject.

M. K. PIKE:—I do not think there is anything that is really causing manufacturers and jobbers, and the whole industry, more worry to-day than the condition of the contractor-dealers in Canada, and the same thing might be said in the United States (we are not particularly interested in their problems, except that we benefit by their experience). Every Association we have, that is, the Canadian Electrical Association and the Electrical Co-operative Association, and all the others, should spend a great deal of their time and energy settling the merchandise end of the business. I was very glad to have Mr. Atchison bring out the points that he did in his paper. I sometimes feel that in the engineering end of the profession we have gone far ahead of the other end. Also that the public utilities overlook to a great extent the merchandise end of the business, because they have to put so much of their time and energy into the engineering and financing end of their business. We have got to a point where, if the industry is going to progress as it should, more attention has got to be paid to the merchandise end of the business by the Associations. It is a very ripe problem for discussion by this Association. We have got to find ways and means to strengthen the position of the contractor-dealer in Canada. As has been pointed out, in Quebec we are beginning to see a little daylight, in that the Province has passed a law, which now, after having been on the books a year or so, has become effective, licensing contractor-dealers before they can do work. That is only the first step. We have got to make them feel, if we can, that they are now a real part of this scheme, and that they have got to improve by hard work in educating themselves to do a better job, and they certainly will not realize that, nor do I think they will do it, unless the Association and the various branches of the industry get behind them. I hope there will be a lot of discussion, if there is time for it, on this one subject.

W. O'BRIEN:—In the sale of electrical appliances, as with other classes of merchandise, we cannot get anywhere unless the thing is advertised. Advertising to-day costs money to do it properly, and I think the dealer, whether it be central station dealer or contractor, should not carry the whole burden. Some of the manufacturers and jobbers (the manufacturers principally) who are most anxious to get their production on the market should bear some part of the burden of the advertising (that is to say, local advertising) so that we can get the public interested in the things we sell. We found this particularly so in the case of gas appliances. We ran an ad. for a certain period (probably every other day in two or three of the principal papers), and sales resulted. We dropped advertising for a week or ten days to see the results. The sales dropped materially. With the return of the advertising there was a strong revival in the sales. We have got to advertise. We should advertise every day, probably through means of an electric page in the local newspapers, where the manufacturers will give a hand in some co-operative advertising. The newspapers are

willing (at least I think some of them are) to co-operate too. If you will give them sufficient advertising space, they in turn will give reading matter, etc. It would be a very good thing if the manufacturers could be approached and that point brought to their attention, as well as the newspapers.

A. A. DION:—I think Mr. Atchison should be congratulated on the thoroughness with which his Committee has covered the field. I would like to ask a question regarding the selling of electric ranges on time payments. I know that that system has been in use, and successfully so, in connection with gas ranges. I didn't know of any case where the time has been extended beyond a year, but I know that with payments extended over twelve months the system has worked well indeed. The percentage of returns is small and the business is profitable. But I had doubts regarding the electric range, because it occurred to me that it would not be very saleable after it was used. We find that gas ranges returned to us can be sold again in every case with a small reduction on the first price—probably 5 or 10 per cent. I question whether you can do that with the electric range, and was wondering if anyone here could give me results of experience — whether this could be made profitable at the ordinary prices.

E. D. FAIRWEATHER:—The Company I am connected with (The Southern Canada Power Co.) have sold a large number of electric ranges on time payments, which arrangement has been very satisfactory. The sale of these ranges has been more difficult than of other appliances, as the public have not been sufficiently sold on the idea of cooking electrically. The consumer does not appreciate what the electric range will do, consequently practically all sales are made in the home instead of in the electrical store. This has been done successfully through our offer of two weeks' free trial, with payments extended over a period of from three to twenty-four months. Out of the total number sold we have only taken back two or three ranges, due to bad payment or customers moving away. Returned ranges have been put in good condition and resold, with probably the same loss as on a gas range, about 20 per cent. These ranges are very slightly damaged and only require a thorough cleaning, with perhaps a new set of elements, when they are made practically as good as in their original condition. At present, we have over one thousand customers cooking electrically, and feel that this number would not have been so large had we not offered extended payments.

PRESIDENT:—Does that answer your question, Mr. Dion?

A. A. DION:—Yes, thank you.

E. D. FAIRWEATHER:—I was very much interested this morning in Dr. Carr's description of a certain electrical store in Ontario, and I am sorry to say that I do not think this is an isolated case, but rather typical of the average store throughout the country. While I am connected with a power company, I am travelling a great deal of the time through-

out the Province of Quebec, and have had a chance to talk to various contractor-dealers. The stores of this description suffer from lack of equipment, and are obliged to display their appliances on tables or shelves, where they become soiled and shopworn, necessitating their sale at reduced prices. They also have a very crude system of filing papers and records, and these are usually found in the display room of the store. The contractor-dealer is used to handling the wiring end of the business, and is, therefore, not apt to be a good salesman of household appliances, which means that there is very little to attract customers to these stores, consequnetly it is necessary to go into the home to sell appliances. It has been found that the average electrical dealer cannot afford to buy expensive showcases, wall fixtures and the equipment necessary to make an electrical store attractive to the public; and I believe it is all because there is not a sufficient margin of profit to allow him to improve this condition. I think, therefore, this is the most serious problem in the sale of electrical merchandise.

W. O'BRIEN:—To what extent do power companies absorb cost of connecting up electric ranges? In Montreal we absorb $50.00 of the cost of installing the service (outside construction) and the consumer bears the remainder. What is the practice of other Companies in this connection and what is the opinion as to what extent a power company should go in financing construction costs for such service?

L. W. PRATT:—Mr. Chairman, in answer to Mr. O'Brien's question, in Hamilton we absorb the transformer cost, if any, and $10 on the cost of the extension. Beyond that, we ask customer to pay for the cost of the service. In comparing practices with Montreal, consideration should be given to the difference in rates in the two cities.

There is one point in connection with Mr. Atchison's excellent paper which I think is worth amplifying. That is, importance of the convenience outlet. You cannot induce the public to use your service in operating appliances or selling appliances, unless you provide adequate means for utilizing such appliances. You probably, at some time or another, all have had the experience of putting a chair on a table and scrambling up on the chair, screwing the lamp out of its socket, and connecting up a vacuum cleaner or some other appliance. You do that once, and then cast the appliance aside and use it no more. We don't want convenience outlets either on the base board where you break your back connecting up. No stone should be left unturned in preaching the advantage of the convenience outlet to the public, contractor-dealer, architect and builder. Explain to them that if you put one convenience outlet in the living-room, put in plenty of them at a good height and use duplex receptacles; it does not cost any more, comparatively speaking, than a single outlet, and you have two for the price of one. A great deal of missionary work can be done by merchandise and sales departments in this respect.

H. A. LANE:—I was just wondering whether the solution of this contractor-dealer situation wasn't to get a little bit better acquainted

with that fellow. Probably some of you have been or are members of the Rotarians or Kiwanis Clubs, or some similar organization. You know what wonderful results you get whenever you start improving something in your city. Everybody seems to know everybody else, call each other by their first name and say "come on, let's do so and so." Do you think that the central stations themselves — the executives in particular, and commercial managers—have taken enough time to cultivate a strong friendship with the contractor-dealer, and has the latter done the same thing with the central station? By getting these fellows together and talking these problems over, finding out aspirations of the contractor-dealer, and what the central stations want to do, perhaps would be the answer to the whole question.

PRESIDENT:—Before we go along to Mr. O'Hara's paper and demonstration by Mr. Hibben, I would like to ask Mr. McIntyre, who represents the Society for Electrical Development, to come up and give us a few words:

MR. MCINTYRE:— Mr. President and gentlemen, this is my first appearance before the Canadian Electrical Association, and I am indeed delighted to be here. I feel very much like the man from Los Angeles who was in San Francisco (and you know there is great rivalry between these two western cities). The residents of the respective towns delight to speak on all occasions about the good features of their home towns. There was a funeral, it seems, in San Francisco, and quite a crowd in attendance. The preacher did not turn up, due to a railroad wreck, and the undertaker mounted the platform to announce the fact, saying "In the absence of the minister, would any of the friends and relatives care to say anything about the deceased?" Several moments silence and no response from anybody. Finally a little old fellow in the back stood up and said "If nobody else has anything to say, I would like to say a few words about Los Angeles." So I am somewhat in that same position. Whenever there is a chance to say anything at all, I am ready to say something about the Society for Electrical Development.

On this merchandise question, it isn't all merchandising, as Mr. Fratt pointed out. It is just as much a matter of selling adequate wiring jobs, not only in the home, but in commercial buildings, in apartment houses, in the public buildings, schools, hospitals, etc.,—the need for selling the public in any case an adequate wiring job.

In order to properly develop this field, there are two things we have to do. Sell the public on the idea to do it electrically, and to educate the industry so far as we can,—particularly the contractor-dealer,—to tie and to cash in on the opportunity created.

Now, there is one field in which the Society for Electrical Development performs an unique service for the industry. That is in selling the public on this idea and entirely by publicity. In magazines frequently you will read articles on the uses of electricity in the home, or in your newspapers, and they are going to appear more frequently than

at present before we get through. You will read very interesting articles about new uses of electricity, whether in the home, business, on the farm, or anywhere. The chances are that the item which you read has been written by one of the trained staff of writers working at the Headquarters. The Society is nothing more nor less than a co-operatively supported publicity bureau for the industry. Its direction is by a board of directors, representing all branches of the industry. Naturally the Society has no axe to grind for any one group. These publications are all neutral in tone. All this work to be effective must be carried on consistently.

Here is a typical page showing copy supplied to the newspapers by the Society. This material is distributed weekly to some six hundred newspapers in the United States and Canada. It will interest you to know that the space given to this electrical propaganda in six months last year, priced at regular advertising rates, was worth around a quarter of a million dollars, four times the cost of operating the Society during that period and we had a hundred and one other jobs in addition.

As Canadian representative of the Society and being in charge of the Society's work in Canada, I am charged with the responsibility of making this publicity go in the Dominion. Analyzing the newspapers and periodicals circulating in Canada, I have found that there are at least ninety-four principal newspapers in fifty-seven towns, fourteen farm papers in ten towns or cities, and 6 principal magazines. We have established contact with 17 of the daily newspapers, and are adding more to the list. Those 17 newspapers, from east to west in the Dominion, receive our weekly electrical news service to-day. We are corresponding with every one of the number of papers and periodicals that I have mentioned, endeavoring to have the material appear. It is electrical propaganda, remember, and when an item appears in a newspaper, the thing that counts is that you have gone to 10,000, or possibly 100,000 readers, so that one appearance covers a broad field. Stories suitable to appear in magazines have been submitted in the past month to four Canadian magazines, "Every Woman's World," "Canadian Home Journal," "Western Home Monthly" and the "McLean's" magazine. None of these stories have as yet been accepted, but sufficient time has not elapsed to hear from the magazines favourably or unfavourably. What I do want you to realize is the fact that we are studying the situation, that we are trying to cover every paper in Canada, and every magazine, and get as many insertions as we possibly can. Further, I do not intend just to get these people on the list, but to follow them up actively and continually, to make sure that the material that is submitted actually goes in. You see, there is an appeal to the publishers too. For example, if they print a certain amount of this material from time to time, they can use it in soliciting electric advertising from contractor-dealers, etc.

So much for publicity,—that helps to sell the public and to create a favourable attitude of mind on their part. But we must also educate the

contractor-dealer and get him working with the rest of the industry in his locality, to tie in and cash in with this. You are all familiar more or less with the work of the several Electrical Co-Operative Leagues at various points in Canada, your own very active Association in Quebec, the Electric Home League, in Toronto, and the Electrical Development League in Hamilton, which has done a wonderful job; 19,886 people in 13 days, an average of over 1,500 per day, visited their electrical home. I take some pride in this. Detroit spent two or three times as much money on one home, with an average attendance of less than 1,000 per day, less than Hamilton, a city almost 10 per cent. of the size. An average attendance of 1,500 in a city of 100,000 or so people, showing that we have possibly a greater interest in things electrical in Canada, something surely we can take advantage of. That comparison can be made not only with Detroit; I speak only of places with which I have had to do myself, but with Buffalo, where they also averaged less than 1,000 per day; and in the first home in Toronto, as you know over 1,500 average attendance per day. See the great interest we have created already. A reasonable amount of consistent effort will produce wonderful results for the electrical industry in Canada.

Assistance and support should be given to Contractor-Dealer Associations. The Quebec Electrical Co-operative Association has also given active assistance, showing what can be done with Contractor-Dealers Associations when the other Branches of the industry take an interest. The same thing applies in Ontario. Last year the membership of the Ontario Association of Electrical Contractors and Dealers was increased 100 per cent. This membership now exceeds 100 and the increased membership was not concentrated in one or two localities, but was spread over eight or nine communities in Ontario.

To assist the individual dealer, to help him in cashing in on this broader publicity work, there is supplied to the Contractor-Dealer members of the Society monthly bulletins giving sales suggestions, frequent booklets on various sales campaigns which he can put on, everything from wiring to selling appliances, and advertising helps which he can use in own advertising. Every month 15 or 20 ads. with cuts and copy are supplied. Copy is given to him prepared, of a type that he could not hope to write himself. Many contractors-dealers in Canada are using the sales helps that I mentioned.

In Kitchener, Ont., as an example of what may be done, and in Waterloo, seven contractors-dealers, being members of the Ontario Association, run a weekly electrical page, which is regarded by our advertising people on the staff of the Society as the best electrical page anywhere on the Continent of North America. Seven average contractor-dealers organized, and working in harmony, to-day, in less than a year after joining their association,—they all belong also to the Society for Electrical Development, to-day they are putting out the best electrical page on the Continent. One week the page contains, describing in a most constructive and appealing way, the advantages of

having the home adequately wired, another time covering proper lighting in the home, or another week on the advantages of cooking electrically. The set up of the page each week is systematically arranged and the individual ads. all conform to the general plan. Every one of these men are doing an excellent business, they all have money in the bank, and when it comes time to pay their dues they pay right on time, which is not always the case with contractor-dealers.

In conclusion, we are likely at times in electrical organization work to feel discouraged, but I think that what has been done in Montreal, in Toronto and in Hamilton and other cities is just a promise of what we can accomplish by working together further. When we feel inclined, possibly, to wonder whether the ultimate goal be possible of attainment, it will be well to remember the motto that seems to have served to please Judge Gary at the head of the U.S. Steel Corporation. He believes in doing it electrically. In his office there is an electrical sign which he regards as the principal piece of furniture. This sign can be flashed on at will by the touch of a button, to tell the doubter who fears failure. This motto of a successful man stating in electrical words: "IT CAN BE DONE."

L. W. PRATT:—Mr. Chairman and gentlemen, we have all listened with a great deal of interest to Mr. McIntyre's constructive remarks. He referred to the partial success of the Detroit Electrical Home and the Electrical Home engineered by the Hamilton Electrical Development League. He neglected to say that the Detroit Electrical Home was not fathered by Mr. McIntyre. That explains the difference in the result in the two campaigns. (Applause)

We, of the Hamilton Electrical Development League and the Toronto Electric Home League, owe a great deal of gratitude to Mr. McIntyre and the Society for Electrical Development. At considerable expense of both time and labour, Mr. McIntyre devoted himself wholeheartedly to insuring the carrying out to a successful conclusion of these two electrical development campaigns, and I repeat that their success was in a large measure due to his efforts. We, of the central station industry, if we wish to continue to get the benefit of this constructive work, must do our part in backing up the Society for Electrical Development.

Mr. McIntyre, in the early part of his remarks, told us a story about a funeral. It reminds me of another story I heard of a Hamilton man who was in a nearby village not long ago. It was raining and he was standing under a dripping awning in company with a few of the natives. It happened that a funeral was passing just then and he asked one of the old fellows sharing the awning whose funeral it was that was passing along the street in a dreary procession. "I don't rightly know," was the reply, "but I think it's that there young fellow's up in the hearse ahead."

The programme this afternoon is anything but a funeral procession, and a glance at the programme will show we have a wonderful pro-

cession of entertainment still in store. It is due almost entirely to the whole-hearted efforts of Mr. O'Hara. With becoming modesty, he is content to rest upon the laurels of his achievements, and as he is busy getting the stage prepared, has asked me, instead of making a resume of his paper, to request the Chairman to call upon Mr. Sam Hibben, who will submit his report, presenting a brief explanation of some new illuminating facts, fundamentals of lighting, shades of colour, and how illuminating engineering is applied to factory lighting.

REPORT OF LIGHTING SALES BUREAU — 1922.

When adequate and satisfactory illumination is submitted for the all too prevalent poor illumination in factories and other working places, the results obtained are mutually beneficial not only to the employees and the employers but to the country as a whole. Under proper illuminating conditions the health, contentment, safety and skill of the employees are maintained at a high standard, the output is increased in quantity and improved in quality, while there is a proportional reduction in the cost of each unit of finished products that reach the public.

While it is desirable to have adequate illumination of the working areas, it is more desirable and essential to proper results to eliminate that light which otherwise would pass directly from the lamps to the eyes of the workers. That is, one must avoid direct glare, which is fatiguing to the eye and causes incorrect estimation of sizes and location of objects in the field of view.

Glare effects may be caused not only by light reaching the eye direct from the sources having a brightness greatly in excess of the brightness of the objects viewed, but they may be produced by excessive reflection—called reflected glare—from the objects within view. In factory lighting each lamp should be so located that the eye does not see it in the ordinary course of work, and so shaded or covered that brillant reflections are avoided. The desired result can be obtained by putting over the lamp an open shade, which screens it and directs downward much of the light which would otherwise be either of no value, or actually detrimental. Or the lamp may be surrounded with a diffusing globe, dense enough so as not to reveal the form of the actual light source within, but to give the effect of the light pouring from the globe as a whole.

While the necessity of good lighting is so evident that a listing of all its effects may seem commonplace, these same effects are of such great importance in their relation to factory and mill management that they are well worthy of repetition and careful attention.

The effects of good illumination and bright and cheerful surroundings include the following items:—

(1) Reduction of accidents.
(2) Greater accuracy in workmanship.
(3) Increased production for the same labor cost.
(4) Less eye strain.
(5) Promote better working and living conditions.
(6) Greater content of the workmen.
(7) More order and neatness in the plant.
(8) Supervision of the men made easier.

In this list it will be noted that items 4, 5, 6, 7 and 8 all have a bearing on accident prevention.

A study of this subject convinces one that—aside from the humanitarian standpoint—the expense incurred in obtaining satisfactory illumination will in practically all cases result in good financial returns.

While the major consideration in the eye of the factory or mill owner is undoubtedly and quite naturally the money value of good light in the larger return of both quantity and quality of work which may result from the installation of a superior as compared with an inferior lighting system, it should be noted that it is very difficult to interpret into dollars and cents the value of good light made possible by such returns. This difficulty is due to the necessity of keeping all conditions in a factory or mill section absolutely constant while varying the amount of illumination from poor to good conditions, in an effort to determine the output and its dependency on the light facilities. As accurate data becomes available, giving the increases in production for certain specific improvements in artificial lighting, it will doubtless prove helpful to a proper interpretation of adequate light and its worth to any plant.

The eight foregoing points are emphasized as forming the most important features in the problem of good lighting. Although difficult to interpret into money values, and somewhat intangible, they are indisputable arguments in favor of the best available illumination from the standpoint of the factory or mill owner.

Practical Example.—Continuing from the manufacturer's point of view it may be said that certain assumptions as to energy costs, cleaning, interest and depreciation show that the annual operation and maintenance cost for the illumination of a typical shop bay of 640 sq. ft. area may be taken at $50.00. If five workmen are employed in such a bay at an average wage of say 25 cents per hour, the gross wages of the men in such a bay, plus the cost of superintendence and indirect shop expense, may equal from $5,000 to $7,000 per annum. In a case of this kind, therefore, the lighting will cost from 7/10 to 1 per cent. of the wages, or the equivalent of less than 4 to 6 minutes per day. We may roughly say that a poor lighting system will cost at least half this amount (sometimes even more through the use of poorly arranged inefficient lamps), or the equivalent of say 2 to 3 minutes per day, the

installation of good lighting will unquestionably easily pay for the difference between good and bad light, through the time saved for the workmen.

Actual Losses.—Superintendents have stated in actual instances that due to poor light their workmen have lost much time, sometimes as much as from one to two hours per day on certain days. If good light will add an average of say one-half hour per day to the output, these 30 additional effective minutes represent an increase in output of 5 per cent., brought about by an expenditure equal to one half of one per cent. of the wages for improved lighting, or a saving equal to ten times the expense.

Remarkable improvements have been made in the electric lighting field. Possibilities in factory and mill lighting are now obtainable through the use of the new gas-filled lamps which were previously unthought of or considered impossible. Consideration of the eye as a delicate organ, together with the new ideas as to the times which affect its comfort and efficiency, have resulted in establishing certain principles in illumination work and have directed attention naturally and in a growing manner to the proper use and application of these new lamps.

We now have a new era in industrial illumination, a distinctive feature of which is the scientific installation of lighting units, suiting each to the location and class of work for which it is best adapted. While certain outstanding cases of improved industrial lighting exist in Canada, there are far too many instances of very poor illumination conditions, where the intensities will not check up with the minimum values of illumination that should be found in a factory as shown in the following recommendation for minimum intensities of illumination:

	Minimum foot-candles on the space or at the work.
(a) Roadways; yard thoroughfares..................	1/50
(b) Storage spaces; aisles and passageways in workrooms, excepting exits and passages leading thereto.	1/4
(c) Where discrimination of detail is not essential...... Spaces, such as hallways, stairways, exits and passages leading thereto; toilet-rooms, elevator cars and landings. Work, such as: Handling material of a coarse nature; performing operations not requiring close visual application; grinding clay products; rough sorting; coal and ash handling; foundry charging.	1/2
(d) Where slight discrimination of detail is essential.. Spaces, such as: Stairways, passages and other parts of power plants where there are exposed moving machines, hot pipes or live electrical parts. Work, such as: rough machining; rough assembling; rough bench work; rough forging; grain milling.	1

(*e*)	Where moderate discrimination of detail is essential. Work, such as: machining, assembly work, bench work, fine core making in foundries.	2
(*f*)	Where close discrimination of detail is essential.... Work, such as: Fine lathe work, pattern making; toolmaking; weaving light colored silk or woollen textiles; office work; accounting; typewriting.	3
(*g*)	Where discrimination of minute detail is essential.. Work, such as: Watchmaking, engraving, drafting; sewing dark colored material.	5

The above are minimum requirements such as are necessary for bodily safety, and are not to be taken as productive intensities in accordance with the accepted modern illuminating engineering practice. To illustrate the intensities shown would enable a machine operator to see moving wheels and belts if 2 foot-candles were provided on the work as called for under the listing "E" under the head of "Moderate Discrimination of Detail," but such illumination would not enable the operator to easily discriminate between moving gears, or caliper a spindle or read a micrometer.

In the industrial lighting field there are at present three distinct types of reflectors, which are especially worthy of consideration. The relative advantages and disadvantages of these types are indicated in the following tabulation, brought out as a result of the tests made over a period of many months by a committee of consulting engineers employed for the purpose by the State of Wisconsin.

A description of these reflectors might be of value. Porcelain enamelled reflectors are made of steel, on the surface of which is coated a bath tub enamel. This enamel coating must be dense, so that as little light as possible penetrates to the steel, for all the light that reaches the steel base is absorbed and absolutely wasted. Enamels vary considerably in efficiency, and if of two reflectors one appears grey in comparison with the other, that one is sure to be considerably lower in efficiency.

The R. L. M. Standard Reflector is a porcelain enamelled steel reflector and is an attempt on the part of the reflector and lamp manufacturers, who jointly worked out this standard, to make it easy for the industrial management to secure good illumination. A number of the leading reflector manufacturers make this type.

Mirrored glass reflectors are made of clear glass blown in the shape of a reflector, on the exterior surface of which a thin layer of silver is coated, and this in turn covered by a protective enamel. To eliminate the brillant images of the lamp filament or streaks and striations which would appear on the surface illuminated, the reflector surface is corrugated.

Prismatic Reflectors, Fig. 1, p. 62, are made of clear optical glass with many small prisms composing the entire body of the reflector. Light control is accomplished by the use of totally reflecting prisms which are

arranged in definite relation to the light source. The prismatic reflectors and units are designed according to carefully worked out engineering calculations. Their prisms may be refracting, reflecting or diffusing and any type of light distribution may be secured with the greatest possibility of accuracy and flexibility.

Since the light in the case of the industrial units is reflected by clear glass only, the absorption is low and the efficiency of these reflectors is exceedingly high.

Indirect Lighting: During the past few years there has been a growing tendency to employ indirect lighting in industrial service. Fig. 2, p. 62. In general, indirect lighting will be found desirable and profitable where a combination of the following conditions exist:—

(*a*) Work involving rather close discrimination of detail.

(*b*) Flat ceilings with relatively few obstructions such as overhead belting.

(*c*) At least moderately clean conditions of work, with respect to dust or oily dirt thrown by belting of machines.

(*d*) Moderate number or large number of workers per unit of floor space—say 15 or more per thousand square feet.

Where the product of the work is of particularly valuable character or where errors of the worker will result in especially costly losses, indirect lighting will generally be desirable even though not all of the above conditions exist.

Indirect lighting is especially to be recommended for many of the operations of the textile industry. Fig. 3, p. 62.

The advantages of indirect lighting arise from the facts (*a*) that, properly installed, it is equal or even superior to daylight with respect to minimum eye fatigue and eye strain; and (*b*) that it eliminates sharp shadows of an objectionable character. These advantages not only make for the safety of the worker and for good hygienic conditions, but they stimulate production and decrease spoilage to an important degree.

Proper spacing of indirect units may be easily determined as follows:—Subtract 3 feet from the ceiling height of the room; multiply the result by 1.8 to determine the best spacing; or multiply by 2.4 to determine the widest permissible spacing. In general sufficiently satisfactory results will be obtained if the spacing does not exceed twice the value obtained by subtracting 3 feet from the ceiling height. For the same size of lamp indirect lighting units will produce about 60 per cent. the illumination on a 36-inch horizontal plane secured with the shallow-bowl porcelain-enamelled reflector, provided the ceiling finish is white.

It will be noted that light units may be spaced considerably further apart when indirect lighting is employed than when direct lighting is employed. Fig. 8, p. 66. This results in the use of fewer light units; so that while the cost of one indirect unit is greater than that of one direct unit, the total cost of installation is usually approximately the same.

Indirect units should be mounted at such distance below the ceiling that the entire ceiling is lighted to an approximately uniform degree.

A special condition sometimes met with in indirect lighting installations, a condition where special treatment is required, deserves special notice. The condition referred to is that where the worker stands close to the wall of the room, facing away from the wall, the work being approximately vertical and facing toward the wall. The ordinary type of indirect lighting installation will not produce, under these conditions, sufficient intensity of illumination on the work. To provide such adequate illumination, the upper portion of the wall behind the worker should be painted white to a distance of approximately five feet from the floor, and angle reflectors should be so located as to brightly light this wall, the spacing of such reflectors being half the spacing of the indirect lighting units which illuminate the rest of the room.

Local lighting is generally to be avoided, though there are occasional industrial conditions where its use may be preferable to any system which provides only general illumination. The most frequently experienced objection to local lighting, and one of very considerable importance, is that the local light of one workman is apt to be so adjusted by the workman himself as to shine into the eyes of any other workman, thereby involving both eye fatigue and a danger hazard, often of serious magnitude. Where local lighting may properly be employed, it is seldom desirable to use a larger lamp than the 50-watt size. Indeed, the 15 watt lamp or the 25 watt lamp is usually preferable, while miniature lamps of very low wattage also have their proper field of application.

Yard Lighting: Although the illumination required in yards is of a much lower order of intensity, the same general principles apply as for interior lighting. In general, lamps may be installed farther apart than for interior lighting, by using special widely distributing reflectors, but care must be exercised that the illumination at any point is secured from more than one direction, otherwise there may be deep shadows cast, where there ought to be light to reveal danger points. This sets certain limits upon the area it is desirable to attempt to illuminate from a single source. Yard lighting lamps should be mounted at least 20 feet above the ground level, higher if possible, to shorten the shadows and minimize glare. If the lamps must be installed lower than 20 feet, lamps larger than 100 watts should not be used. Shallow bowl porcelain-enamelled reflectors of the weatherproof type may be used to good effect, but the spacing between units should never exceed four times the height above the ground. Prismatic refractor units permit a spacing between units of eight to ten times the height above the ground.

A comparatively recent development particularly adapted to yard lighting is the flood lighting projector. It is very useful in cases where the conditions make it necessary to install the lamp at a considerable distance from objects or areas to be illuminated. It is of great value for safeguarding property, for facilitating the carrying on of night construction work, for factory and switching yards, docks and piers,

enabling necessary night work to be carried on at day-time efficiency. The flood light is not designed to throw a concentrated beam, but rather to spread light evenly over a comparatively large area. Some makes of these lamps are provided with a focussing device, by which the projecting light may be made to suit conditions, giving a concentrated ray for long distance and a wider, more diffused light for nearby use. It is especially valuable where conditions make it impracticable to use the ordinary type of lamp and reflector, and where a span or a bracket cannot be used.

Maintenance: No paper on industrial lighting could be considered complete without reference to the very necessary question of maintenance.

Lighting installations are designed to give desirable initial illumination intensities on the work, but if the illumination is to continue satisfactory, adequate maintenance must be instituted. In time, lamps, globes and reflectors become covered with dirt. The lamp bulbs become black and burn out, reflectors are damaged and the electric wiring may become defective. Due to any or all of these causes the illumination in the shop deteriorates to the point where complaints are produced. The losses of time from such circumstances when totalled for a period of a year will be found, in all probability, to exceed the expense of systematic attention to such items in advance.

The loss of lighting though dirty lamps and reflectors in the average plant will run from 10 per cent. to 12 per cent. per month, and there are cases on record of losses as high as 32 per cent. in seven weeks.

Enormous losses have been shown by dirty walls and ceilings also. Those ceilings, stained and darkened by smoke and dust, are some of the initial causes of deficiency in illumination.

An office lighting installation recently examined is a point. The installation consisted of indirect units and had been in operation two and one-half years. The ceiling had been painted a flat white and the walls finished in a light buff. At the time the installation was made the intensity was adequate.

The engineer who investigated this installation in response to a complaint found that the average illumination intensity on the desk tops was 2.7 foot-candles, unquestionably too low for office work.

(1) The reflectors had been wiped out at fairly regular intervals, but were nevertheless taken down and thoroughly washed. The illumination jumped at once to 3.7 foot-candles, an increase of over 35 per cent. upon washing what appeared to be fairly clean reflectors.

(2) The lamps had been in service for more than two years. Furthermore, it was found that their rating was several volts higher than the average voltage of the circuit. When new lamps of proper voltage rating were substituted, the illumination increased to over 5 foot-candles.

(3) The ceiling of this office, which two and one-half years ago reflected about 75 per cent. of the incident light, and become soiled

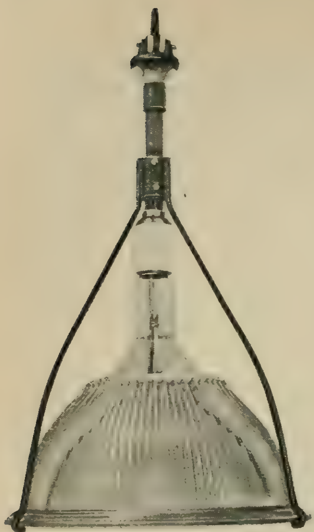


Fig. 1

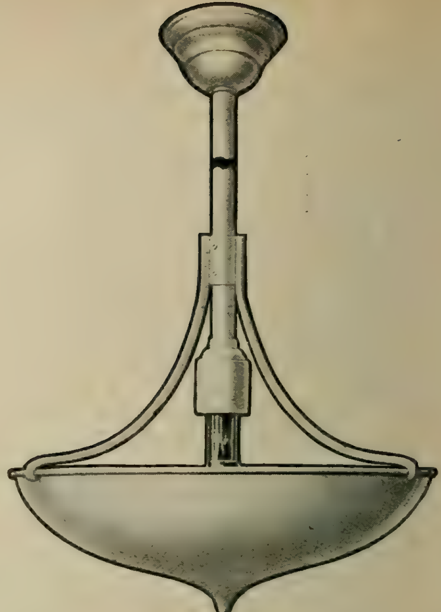


Fig. 2

Fig. 3

FIG. 7

FIG. 8

through soft coal smoke to the point where it reflected 53 per cent. The side walls had depreciated in like proportion. Refinishing the office in its original tone further increased the illumination by about 40 per cent., or to a total of over 7 foot-candles.

Here is a case where failure to observe simple maintenance requirements resulted in an intensity of 2.7 foot-candles where an intensity of over 7 was being paid for.

There are two methods by which the maintenance of any selected standard of intensity can be assured; first, by allowing for an enormous depreciation in the light, and, consequently, using much larger lamps than would ordinarily be considered necessary; and second, by maintaining the system properly and allowing for reasonable depreciation.

The second, or practical method involves:—

1.—The use of a depreciation factor, or factor of safety, in the original design of the system to insure adequate illumination when the system has depreciated a normal amount.

2.—The cleaning of lighting units at regular, frequent intervals.

3.—The replacement of lamps which have become blackened in service by abnormally long life.

4.—The use of lamps of the correct voltage rating for replacements.

5.—The refinishing of ceilings and walls when necessary.

Expert Assistance: The advantages of securing expert assistance in dealing with problems in illumination cannot be too strongly emphasized. The points which come up for solution are complex and varied and require in many cases the judgment of one who has had wide experience in the lighting field.

INSTRUMENTS FOR DETERMINING ILLUMINATION INTENSITY

The Foot-Candle-Meter is the simplest and least expensive instrument, having a stationary comparison lamp and scale. The brightness of this comparison or standard lamp is regulated by a rheostat and volt meter, previously calibrated in a laboratory. When the lamp is held at the proper brightness, the spot on the scale that appears to fade out is receiving an equal amount of illumination from the comparison lamp and from the outside source of illumination, thus indicating directly the value of illumination falling upon the scale from above.

The Light Meter is similar, except that the battery, ammeter and photometric head are all assembled in a single tube. The comparison lamp and battery are in an inner case, to the end of which is attached the ammeter and rheostat, and which slips inside of the outer tube. The distance between the comparison lamp and the photometer cube is regulated by moving the whole inner case on which is engraved a scale reading directly in foot-candles. The ammeter is attached directly to the rheostat, and the current in the lamp is regulated by turning the ammeter about its axis. No auxiliary battery case is needed with this

instrument, since the standard lamp is supplied by a regular flash-lamp battery slipping within the tube.

This light meter is the very latest development of its kind. It will measure illumination intensities on the direct scale from 1/100 of one foot-candle to 1,500 foot-candles, and will read much higher by the use of additional screens.

J. H. O'HARA, *Chairman.*

PRESIDENT:—Is Mr. Hibben in the room?

Gentlemen, I want to introduce Mr. Hibben, who has been for many years associated with lighting and illumination work. Mr. Hibben is the Manager of the Illumination Bureau of the Westinghouse Lamp Co. of New York.

FUNDAMENTAL PRINCIPLES OF ILLUMINATION

By Samuel G. Hibben, Illuminating Engineer Westinghouse Lamp Company

About twenty years ago the purchasing agent of any large manufacturing plant ordered coal for his boilers at so many dollars per ton or per bushel. He did not care to know, or endeavor to ascertain, the BTU, the per cent. of ash, the clinkering qualities, or whether this particular commodity actually did for him what it was supposed to do, namely, generate heat or supply steam; in other words, he purchased an article, and not a result.

When we buy gasoline for our automobiles we endeavor to ascertain "how much per gallon," but we should also ask "how many miles per gallon." What we wish to know is not only the cost, or weight, or color, or smell, or destiny of the gasoline, but we have learned to ask whether it would accomplish a certain purpose. And we willingly purchase 72 degree rather than 68 degree gas, because we get better performance, less carbon, more mileage,—actually lower costs per mile.

We do not buy a pair of shoes at ten dollars per pound of leather. We purchase an article that has a certain color and a certain quality of leather, but which, in the last analysis, must fit our particular feet, and must wear well, and feel comfortable. All the years of skill and research of the tanner have resulted in pliable and durable leather; all the art of the shoemaker has been expended to fashion the shoe, but if we buy merely a pair of shoes how foolish would we be, and how extravagant such a scheme of purchasing would be! "Any old shoe" could be the source of untold pain and dissatisfaction. A proper, modern shoe, selected intelligently and fitted to our feet by one who knows shoes would be a thing of pleasure, pride and service.

This same line of thought should apply to better industrial lighting. With our increased education and the development of our knowledge of illumination, we are learning to inquire whether our lighting in the factory is accomplishing a definite result and whether it fits well and serves properly. We should buy not merely lamps, sockets, wiring

and reflectors, but we should purchase the only thing for which we really pay out good money, namely, proper usable illumination.

There is a science in factory lighting as definite and as sure as in the profession of medicine. There is always at your command a "doctor of light" who will prescribe for you, consult with you and help you. To intelligently utilize any commodity, however, we must have some understanding of its characteristics. It may therefore be of value to explain some of the more important terms used in illuminating engineering, and to demonstrate some of the fundamental principles of light.

The basic standard of all light measurements is the "candle," which measures the pressure or intensity of a light source in any given direction. The unit of comparison one candlepower is produced horizontally by a standard candle burning under specified conditions. This standard is known in United States, Great Britain and France as the "International Candle." An ordinary commercial tallow candle gives approximately one candle power horizontally. Candlepower, it should be noted, measures the strength of a light source in one particular direction only. The old lamp rating of eight and sixteen candlepower meant that these lamps radiated eight or sixteen candlepower in a direction at right angles to the axis of the lamp. It makes no

FOOT-CANDLE-METER

difference where we place the lamp or how it may be used; over one's desk, on the sun or in the closed black box it still radiates the same candlepower.

Now if this radiated light falls upon an object or surface, there is an illumination of that surface, the value of which we measure by the "foot-candle." One foot-candle is defined as the illumination produced on a surface one foot distant from and perpendicular to the rays of a one candlepower surface. Thus, if we hold an ordinary tallow candle twelve inches from a vertical wall, we will have an

illumination of approximately one foot candle on the wall at a point directly opposite the flame.

There is nothing confusing or complicated in this term. We measure how heavily we press down on a surface such as the platform of a weighing machine, by pounds—we can measure with a yard stick the depth in feet of a fall of snow on the sidewalk—and we can measure the illumination upon a surface such as a table top in "foot candles." But instead of the weighing machine or the yard stick, we have for measuring values of illumination the "foot-candle meter."

Of the several portable light measuring instruments in general use, the foot-candle meter is perhaps the simplest and least expensive instrument. It consists of a standard lamp; a voltmeter and rheostat for holding the lamp at a calibrated brightness, and an opaque screen containing a series of small round openings covered with a translucent paper. The lamp is placed at one end and illuminates the under side of the screen. The end nearest the lamp of course receives a higher intensity of light than the far end, while the illumination on top of the screen, i. e., the illumination we are measuring, is practically uniform for this limited area. The light transmitted through the openings thus causes those near the lamp to appear brighter and those away from the lamp darker than the screen itself. The point where they change from light to dark is the spot at which the illumination is the same on both sides of the screen. These holes are calibrated to read directly in foot-candles. We can see at a glance this neutral point and can thus read the illumination on the screen. The instrument is convenient to handle and the illumination at any point, the table of a drill press, the side walls or the desk top may be easily determined.

The unit of measure of the intensity of a light source as explained above is the candle and that of illumination, the foot-candle. Another equally important term is that for measuring quantity of light. This is called the "lumen" and is the quantity of light which will illuminate one square foot of surface to an intensity of one foot-candle. Thus a table top having an area of fiteen square feet would require 30 lumens to illuminate it to an intensity of two foot-candles. Sixty lumens would produce an illumination of four foot-candles.

Light can be controlled and adapted to our needs. Some of its fundamental principles may be readily demonstrated by projecting a beam of light through a glass box filled with smoke. Lenses will contract or broaden the beam; a convex lense for the former and the concave for the latter purpose. A clear pane of glass allows the beam to pass directly through with no other effect than a slight absorption, say 10 or 15 per cent. If, however, the glass is held at an angle, the beam will be partially reflected and partially transmitted. When held at a definite position in relation to the beam at what is called the critical angle, the beam will be totally reflected. Ribbed glass, it may be shown, will spread the beam in one direction such as vertically or horizontally. When glass of this character is used in factory windows,

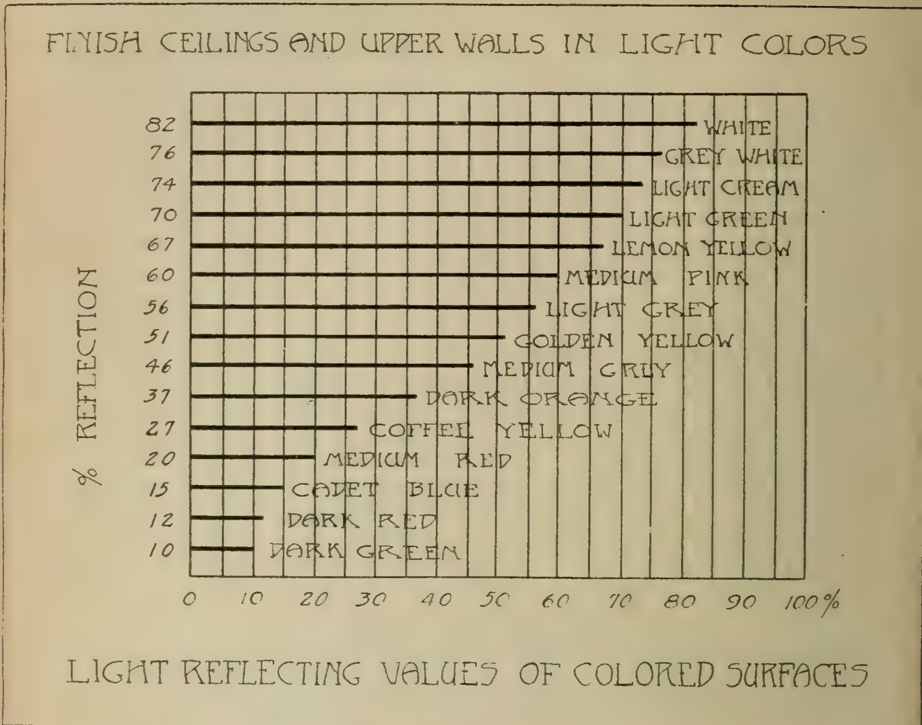


FIG. 2.

the panes should be installed so that the prisms are horizontal, thus directing the light to the ceiling and across the room. In using window glass of this type curtains should be provided so that they may be drawn over the window when the direct rays of the sun strike the glass and its brilliancy becomes too intense for the comfort of the workmen. By interposing a triangular glass prism in the path of the light beam, we can show how the beam may be diverted in any desired direction. A frosted or opal glass will break up the beam and diffuse the light rays in all directions. When colored light is required, glass or gelatin screens will transmit their own color to the beam by absorbing all other colors. It is interesting to note that colored glass when held at an angle to the beam transmits the color light, but the reflected portion of the beam is unchanged in color.

Reflected light is either specular or diffused, depending on the character of the surface from which it is reflected. A highly polished surface will reflect the beam in any direction, depending on the angle at which it is held. A mirror re-directs the beam without altering its shape and only absorbs 5 or 10 per cent. of the light which strikes it.

If we hold a block of magnesium carbonate in the path of the beam, the rays will be reflected in all directions. In other words, the beam will be diffused. The magnesium carbonate block reflects about 98 per cent. of the original beam. Porcelain enameled steel, such as used in industrial reflectors, would reflect approximately 85 per cent. of the light. Figure 2, page 68, illustrates graphically the percentage light reflection for various colors.

The appearance of objects may be entirely changed by subjecting them to different colored lights. This might be shown by throwing various colors such as red and then green on a vase of flowers. The leaves under the former light will appear black while roses are seen most vividly. Similarly the green light would show the leaves in their true color while the reds would now appear black. Carefully selected colors are of utmost importance in display and show-window lighting in order to attract attention and to exhibit merchandise to its best advantage.

Frequently in merchandising or in industrial work, such as grading sugar or tobacco, sorting tin plate or judging between copper and brass, it is necessary to work under light approximating daylight in color. This may be obtained by the use of the blue bulb Mazda Daylight lamps, which screen out some of the red and yellow rays and furnish an almost daylight illumination. For very accurate color matching or identification, there are available specially designed daylight units which filter the light of a clear bulb lamp through a very carefully selected color screen.

One of the questions that naturally occurs to every man is "how much light is required to see well"? To answer that, we must first know what we are trying to see—not only its color or size, but whether it is still or moving. Stationary objects require more than just "some light." Without thinking, we assume that if we can see an object, then that is all there is to it.

There are, however, different degrees of seeing, i.e., we can see better if light is more adequate. If we take a Snellen, an ordinary optician's eye chart and illuminate it to about three foot-candles, we could probably read at a distance of twenty feet the first three or four lines of type. Now, if we increase the illumination to about 15 foot-candles, we find that we are able to read one or two finer lines of type. Still higher values of illumination will permit us to read additional lines and to read the former lines with greater accuracy and ease. It is easily shown that visual acuity depends upon the value of the illumination and explains that poor light means poor work. A workman cannot eliminate imperfections if he cannot see them.

Equally true is the fact that good lighting is required to see moving objects—in fact it requires more light for such vision than for seeing the stationary things. After all, the human eye is only a moving picture camera, and as we walk about through life we continually take films of pictures on the retina, developing them in the

dark-room of the brain. You all know that it requires a time exposure to take a picture at twilight, but did you ever stop to consider that when the artificial light is dim, the eye requires a "time-exposure" as well? No one can take the eye-picture instantly, and the dimmer the light, the slower the impression on the retina. This is called the "time-element" of vision. This is why good light enables us to see quicker, to move with less hesitation,—to speed up production.

No man ought to have to lose a finger on a buzz-saw before he is convinced that moving objects may be invisible. No man ought to have to lose factory output and profits before he believes that good light may make invisible or dim objects visible.

The practical side of this question is shown in Figure 6, page 155 which illustrates the seasonable variation of both fatal accidents and daylight illumination for the various months of the year, and illustrates how accidents increase during the winter months when daylight is inadequate.

Under some conditions, however, too much light in one place is worse than too little. This we know as glare, and almost any bare light source, especially against a dark background, produces a dazzling and blinding effect detrimental to both health and vision. You will be surprised to find how poorly your eyes function when there is a bright light in the field of view. To appreciate this, glance for a moment at the brilliant light source of a lamp and then try to read the text of a newspaper. You now see glare at its worst, and if you should stop to consider how many cases of this sort exist, do you wonder why operators get headaches and fall over castings or wear glasses, or in defense put paste board or rags around bare lamps.

Not only must the proper intensity and the quality of light be provided however, but its direction should also be considered. Many factories require illumination of vertical as well as horizontal surfaces, and in some cases castings and machines can be more easily delineated if certain shadows are present. Fig. 7, page 63. Usually we are safe in eliminating large areas of dark shadow, but entirely shadowless illumination may not be the unqualified desideratum. Too many dark shadows —resulting from too small a number of large units or from injudicious spacing—are likely to be a source of trouble; but, on the other hand, the careful study of light-direction is wise, because the utter lack of shadow may confuse our vision. Shadowless objects are flat like unseasoned food. Salt in large doses is bad, but a little of it, where it belongs, makes a world of difference in the flavor of the meal.

If we were to take three different shaped vertical rods, one round, one square and one triangular, and light them uniformly on all sides, it would be impossible to distinguish the different shapes. Some shadows are necessary. This is especially true in the flood lighting of a monument or a building. An absolutely uniform illumination renders architectural detail almost invisible and destroys the beauty of works of sculpture.

After a lighting system has been installed to meet the special requirements for which it was designed, it must be properly maintained in order for it to fulfill its purpose. Figure 4, page 154 graphically shows the depreciation of light by the accumulation of dirt and dust on the lamp and reflecting equipment. Even with clean surroundings we may reasonably expect a loss in efficiency of approximately 25 to 30 per cent. in the course of a single month. While ordinarily the films of dust that settle on the lamps and reflectors may be wiped off, the figure illustrates how the washing of the equipment is needed to bring the installation to its maximum efficiency. In machine shops, garages and similar places, where the accumulation of dust is oily, it is not sufficient to merely wipe off the lamp or the reflector as it leaves a thin invisible film of grease to which a new layer of dust readily adheres. Such equipment should be thoroughly washed in soapy water, thoroughly drying with clean rags, preferably after rinsing in clean warm water.

Another feature involving the efficient operation of a lighting system is that of voltage, the first of which is shown graphically in Figure 3, page 153. This illustrates the loss in light output when lamps are burned at under voltage; a drop in voltage of 5 per cent. will result in a 15 per cent. light reduction, and a 10 per cent. in a loss of 29 per cent.

In order to operate an industrial plant at maximum efficiency or to meet the exacting requirements of keen competition, the factory superintendent or store manager should not only know what illumination is necessary for his needs, but also how to maintain a good lighting system after it has been correctly installed.

PRESIDENT:—Before the meeting breaks up, we have some exhibits in the adjoining room, which are well worth your investigation. The Accident Prevention Committee has a display, and there are some meters on exhibition. We might have time this evening, or immediately after this meeting, to take a walk through that room.

The moving pictures we will try to show to-morrow morning, if we can work in with the programme.

Now, we will be glad to have some discussion of Mr. Hibben's very valuable paper.

SECRETARY:—I was particularly interested in the paper of Mr. Hibben, as I take pleasure in things concerning illumination. Whether this is due to a natural disposition on my part for anything which involves the science of colours I cannot say, but I feel that in the electrical business up to comparatively recently we have given a considerable amount of time (mostly time and energy) towards what makes the wheels turn. It seems from now on we can feel that electrical engineers will give some thought to the beautifying of life, that is to say, the aesthetic side of life. I believe the more we study these questions (not only from the point of view of enlarging sales for the various companies, but also from the point of view of making life more pleasant and beautifying our homes or wherever we have to spend our time), we

will find the field is almost unlimited, and men like Mr. Hibben and others who are illuminating experts are doing praiseworthy work by devoting their time to this subject, for the good of the community in general.

MR. MCINTYRE:—Mr. President, we have had an example this afternoon of how simple and clear and understandable a subject of this nature can be made by demonstration. We have in the electric home an example of how we can sell the public on adequate wiring, by displaying and showing something that they can see. The industrial lighting exhibit has been developed for the same purpose, selling good lighting to the buying public.

MR. HIBBEN:—The industrial lighting exhibits, to which reference is made, consists, as you all know, of a portable miniature factory, perhaps 20 x 30 feet, in which various lighting systems can be shown. I believe there have been something like ten of these different exhibits moving around through the United States, and yet the field is not covered by any means. My own Company has one on the road, and it is meeting with great success, there is no question about that. It is a question of getting it far enough, and moving it fast enough, to fill all the demand for it. Any of these portable exhibits are worth more, I believe, than months of solicitation. The purpose of the exhibit is to put it up in any available location, and have a crowd of 25, 30 or 40 around to demonstrate to, perhaps leaving it in one location for several days. I have demonstrated to crowds anywhere from 25 to 100 people at a time, and showed them what good and bad illumination was. I have shown old drop system carbon lamps, overhead lamps equipped with reflectors, and actually demonstrated conditions of factory lighting. We hope to get these into places in Canada at an early date. My Company will be glad to loan the exhibit just as soon as it is released from some of its engagements in the United States. Local organizations could build one of these exhibits, and I will be glad to furnish plans and drawings for one if anyone desires same.

PRESIDENT:—We have listened with a great deal of pleasure to a very important lecture. We have another one this evening that also, I am sure, will be exceedingly interesting and instructive. Mr. Hibben, in dealing with this question of lighting, and in reviewing some of the things we learnt when we studied physics in school, has, by a few comparatively simple experiments, demonstrated the principles underlying this subject. I remember a year or two ago I was in New York at a theatrical production. It was the first time in my experience these devices were used on such a large scale on the stage. The whole stage, with all the costumes and everything, was suddenly changed from one colour to another by the use of different lights, and it really was a most wonderful exhibition. I wondered afterwards why these devices were not used more frequently, and we do not see them in other places than the theatre. I think the subject is one that is not adequately dealt with by those of us in the engineering life. It needs, I think, a

man of a certain artistic temperament, with a sense of colour, to appreciate the importance of this subject of application of illumination, not only to such things as factory illumination, but to the addition to the pleasure of life in the home and other places. Mr. Hibben outlined in his address the fact that a great deal of work has been done, as he has well demonstrated, and the interesting thing to all of us is, there seems to be a certain amount of attraction in this sort of thing that undoubtedly is going to spread out and educate all of us, and also the general public, to a very much greater interest in this subject.

If there is no other discussion, gentlemen, I want to remind you to be on time to-night at St. Patrick's Parish Hall, which is only a short distance. The time is 8.15, and we are going to receive a very interesting lecture by Mr. D'Arcy Ryan.

P. T. DAVIES:—Mr. Chairman, I would like to propose a vote of thanks to Mr. Hibben for coming here to-day and giving us this demonstration. We were all very much taken with it, and I think Mr. Hibben deserves our heartiest vote of thanks. (Applause)

MORNING SESSION, FRIDAY, JUNE 16.

PRESIDENT:—We had better get started, as we have a long programme. I think the other delegates will probably come in as they are through breakfast.

The first item on this morning's programme is report of the Technical Section, by Mr. Beaumont, Chairman. Is Mr. Beaumont here?

R. J. BEAUMONT:—What is set down on the programme as the report of the Technical Section may be considered as being just a few remarks dealing with the work of the year.

The Technical Section consists of the Chairmen of the Committees. Work was commenced early after appointment of Committee Chairmen by the Executive Committee. At the Technical Section Meeting, Committees were organized and plans for the year made, with the final result as shown in the various reports.

I will not go into any detail as to the contents of each report, as it would only be covering the ground which must of necessity be touched on by the Committee Chairmen. But there are several items that I would particularly like to call attention to:

In Mr. Kenyon's report the subject of dielectric loss in cables is discussed. There is an attempt to carry forward the work, somewhat similar to that being done by the parallel committee in the N.E.L.A.

Particularly interesting, I believe, is the report of the Overhead System Committee, in that part dealing with the thermal loading of transformers. I think I am right in saying that the Shawinigan Company was the first company in Canada to apply this. About two years ago we commenced to install thermal thermometers on the transformers of our distribution system in the Town of Shawinigan Falls. Soon after that the various schemes which are described in the report came on the market in Canada.

We are particularly indebted to Mr. Stanger for his thorough work in the preparation of this part of the paper.

In the report of the Inductive Interference Committee, it will be noticed that we have the co-operation of a representative of the Bell Telephone, in the person of Mr. A. I. Peterson. The Chairman, Mr. Trimingham, attended the N.E.L.A. meetings held for the discussion of this subject, and I hope our members will find this report of value, as it represents a very serious work on the part of the members.

The Lamp Committee is a new Committee for this year, and it was the intent that the paper be educational.

Concluding, I wish to express my appreciation for the work done by Chairmen and Committee Members, and hope that the results presented to-day will be of value to the Association. (Applause)

PRESIDENT:—Gentlemen, I think we will pass to the following reports, to which Mr. Beaumont's is considered as an introduction. The first is the Meter Committee.

REPORT OF METER COMMITTEE, 1922

Your Committee was organized early in the session, and well attended meetings have been held. In forming the Committee, an endeavor was made to cover as wide a portion of our membership as possible and to obtain members who would render active support. Some members from distant sections, who were not able to attend meetings, have kept in touch with the Committee by correspondence. There is still a need, however, in your Committee for a wider Central Station membership, and it is suggested that member-companies see that the services of their competent metermen be brought forward for this purpose, and that, when appointed, the necessary support be given them in their Committee work. Your Committee has greatly benefited by being associated with the National Meter Committee in its active work, and whilst duplication should be avoided, it is thought that several subjects taken up by the main Committee can well be brought up in our own report, as by that means being put more generally before our own membership.

Early in the session, several subjects, which were considered of interest, were circulated amongst the members of the Association, and the replies received have been taken as a basis for the report on these subjects.

It may be noted that, with several of the subjects considered, definite conclusions or recommendations are not arrived at. Your Committee would, therefore, ask that not only are these subjects discussed in as full a manner as possible at this Annual Meeting, but that information which may occur to anyone from time to time be forwarded to the Committee Chairman, so that future reports may be more elaborated.

METER SEAL PERIOD

Acting on the report of last year's Meter Committee, a special committee was appointed by the Association to deal further with the matter of the meter seal period. The co-operation of the Association of Municipal Electrical Utilities was obtained and a joint memorial was presented to the Minister

of Trades and Commerce asking for an extension of the seal period. This memorial took the form of a petition signed by practically all the meter users in Canada stating the number of meters owned by the particular utility and giving it as their opinion that the seal period should be extended.

Action on this memorial was deferred until the next session of the government, and in the meanwhile we were asked to continue to gather data as evidence of the necessity of the extension. We, therefore, ask that all member-companies submit at regular intervals the record of meters tested so that we may add this to the evidence already presented. Forms for this purpose have been printed and are being distributed, and it is very important that these forms be turned in by each member-company.

METER STANDARDIZATION

Your Committee decided to leave all questions of design of meters and metering equipment to the consideration of the Watthour Section of the Canadian Engineering Standards Association. A meeting of this section was held in August, 1921, and the work was started in a most successful manner. Representatives of all meter manufacturers were present, together with meter users and the Director of the Electricity Inspection Dept.

The discussion of a proposed draft of rules was exceedingly valuable by reason of the wide representation present. Although preliminary drafts only have so far been discussed, beneficial results are already noticeable in that manufacturers are introducing features of design which were seen to be favoured by the meter users. The work is being actively followed up by your Committee, and member-companies not having direct representatives on this Section should use the C. E. A. representative as a means of stating their requirements.

HANDLING OF METERS

It is found in practice that considerably more damage and resulting inaccuracy may be caused to meters by bad handling between test room and consumer than by years of undisturbed operation under normal service conditions.

Slight injury to the meter after sealing may never be detected until the end of the seal period, and if detected soon after installation, the expense of the Government seal and test is a straight loss. It is noticeable also that the proportion of stopped meters is the largest amongst meters that have been installed for a short period, and it should be the endeavour of all metermen to reduce this number of stopped meters to a minimum.

Such damage is mechanical damage due to extremely severe handling or to the shifting of adjustments or change in relationship of elements. Magnet screws are liable to become jarred loose and the adjustments changed or magnets moved to touch the disc. Elements may be moved in position, register gear wheels damaged, gears knocked out of mesh or balance of rotating element upset. Damages to jewel or pivot affecting the meter mostly at light load are difficult to detect.

Replies on this subject from member-companies showed that it is most common practice to personally carry the meters to and from the test room. The meters are in some cases carried two or more at a time, suspended on each

side of the body by a strap across the shoulders, the meters being suspended vertically from their top mounting bolts. In this method of transporting, the following points should be guarded against:—

1. Do not allow the meters to knock against one another when being carried.
2. Do not take the meters from the shoulders by the strap allowing two to come together with a jar.
3. Do not set the meters down on a hard surface in a vertical position.

This practice, because of the liability to do any of the things above mentioned, could be improved upon. It also necessitates most meters being carried in a vertical position with the weight resting on the jewel and pivot, every vibration which is liable to occur being in perpendicular direction to the plane of assembly.

It is considered that better practice would be to devise carrying boxes of suitable size for the meters handled, with felt washers to take up the jars. These boxes should have handles so placed that the meters are kept in a horizontal position, the weight of the moving element then being on the side of the jewel and any vertical vibration being then liable to occur in the plane of assembly.

Trucks were reported as being used in towns where the number of meters to be handled warranted their use, and various precautions to take up vibration are used. Most general practice is to place the meters on their backs on the floor of the truck, the floor being first covered by a mattress or layer of thick felt. The meters are kept from sliding around and striking against one another by felt strips or by the use of separate compartments. Some companies made use of the pressboard cartons similar to the manufacturers' original containers or of corrugated board which is found to be an excellent absorber of shocks. Excelsior packing is also being used but would appear to have many disadvantages. One member-company is having special boxes made up for truck transportation, as shown in the accompanying drawing. This would appear to be an excellent system where the sizes and types of meters do not vary very widely. When handling by trucks, the men should be instructed to carry the meters from consumer to truck carefully, one at a time, and to exercise same care in carrying from truck to storage rack.

By exercising care along the above lines, the possibility of damaging a meter during its periodical trip to the test room for calibration may be lessened.

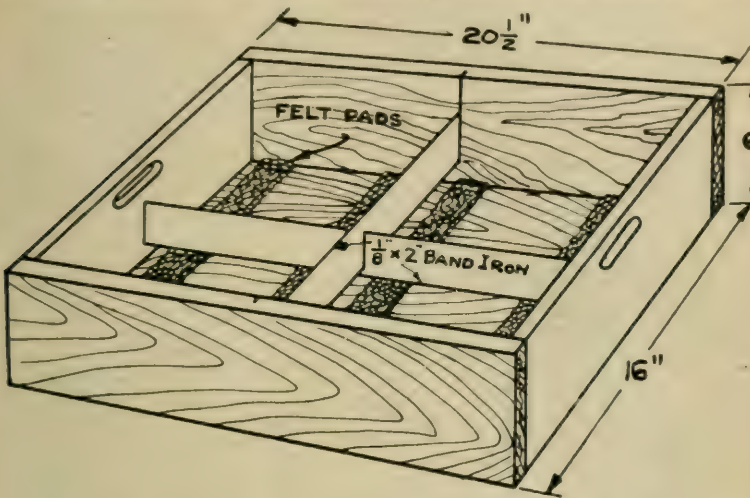
The meter testers must also appreciate that a loose screw in the meter may readily destroy the value of the work, and should be told to inspect each meter as the last step for such loose screws.

Spring jewel supports are favoured by European manufacturers as giving protection to the jewels and pivots against vibration in a vertical direction, but it is an open question as to whether the additional security is sufficient to warrant the additional expense.

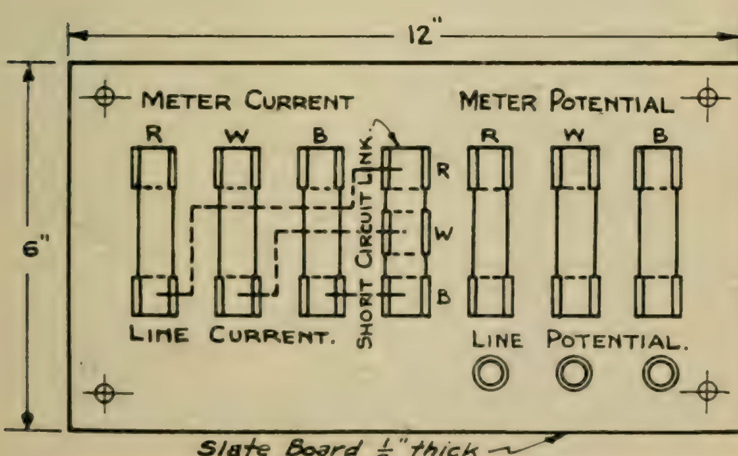
The replies show that, as a general rule, meters are received in good order from the factory, the system of packing generally adopted by the makers of individual corrugated board cartons giving good protection. When shipping by rail, use should, therefore, be made of the manufacturer's original corrugated board cartons.

METER INSTALLATION

The subject of the correct method of installing meters and the selection of location for meters on the consumer's premises is one which should come



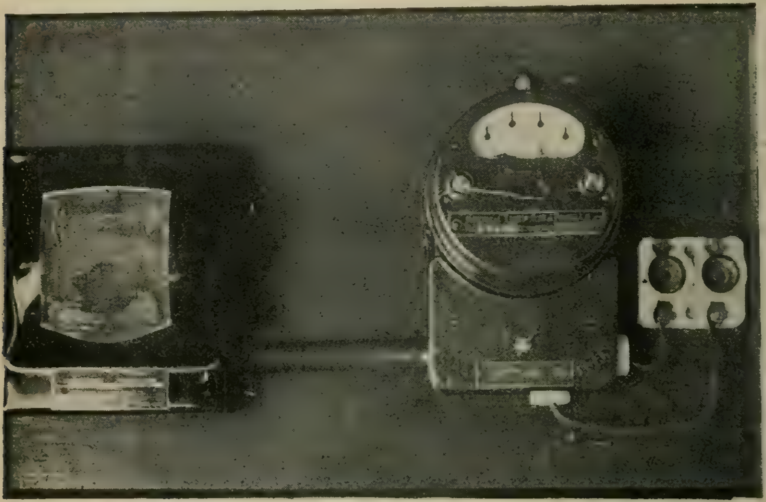
BOX FOR TRUCK TRANSPORTATION OF METERS.

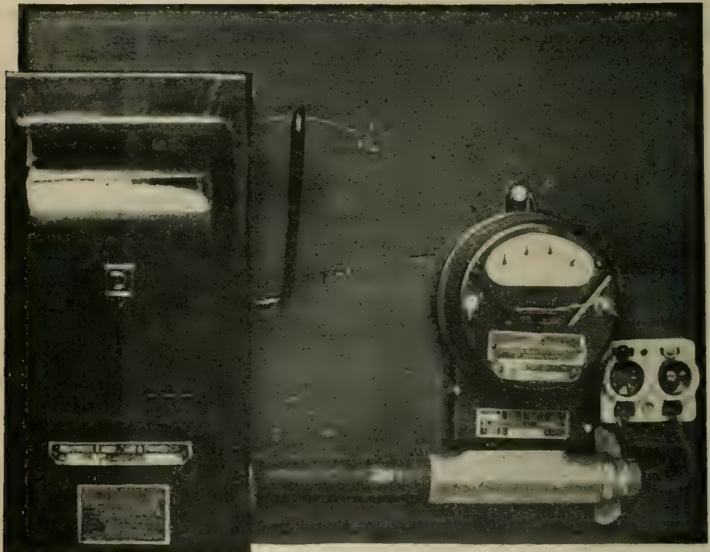


METER TEST BLOCK.

under the jurisdiction of the Meter Department. In some localities the

whole question of wiring is covered by civic or provincial by-laws, and when these by-laws have made suitable regulations covering installation of meters, they work out very nicely without great effort on the part of the



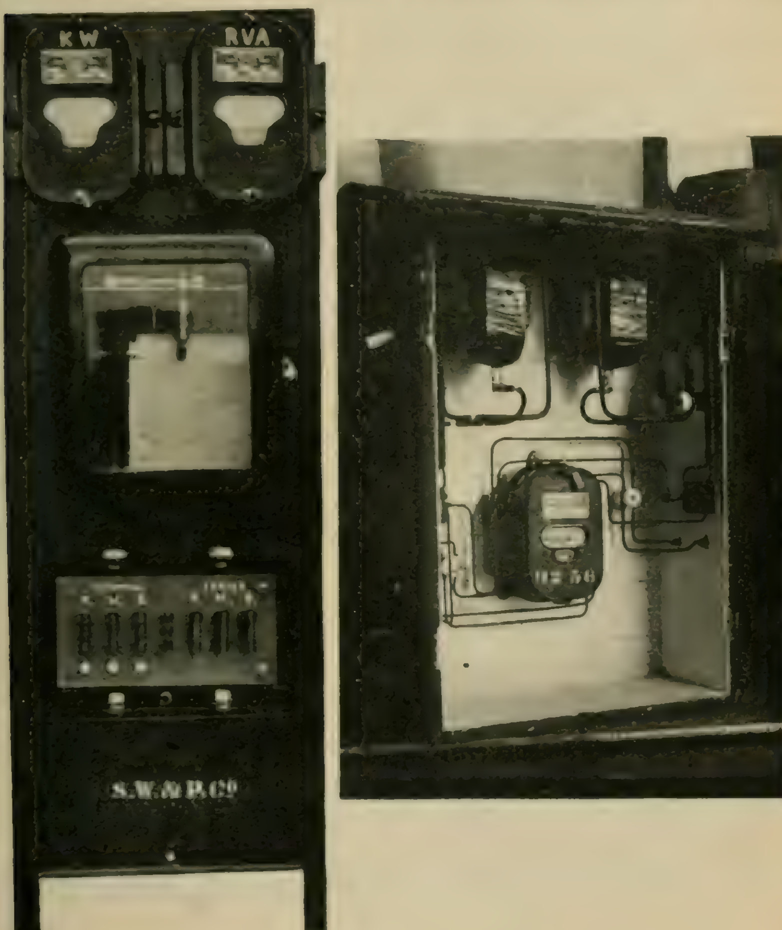


TYPES OF METER INSTALLATIONS

Company. The adding of a paragraph covering service entrances to the Fire Underwriter's code has been of great assistance in obtaining properly protected service switches and fuses.

Some member-companies report that they have under consideration the drafting of rules covering meter location and wiring, which will be supplied to wiring contractors and architects.

As a general rule meters should be located in the basement or first floor, as near as possible to service entrance in a clean dry place where they will not



TYPES OF POWER METER INSTALLATIONS

be subject to vibration, dampness or extremes of temperature. The latter rule would oblige all meters to be located indoors, except in localities such as the Pacific coast, where temperature variation is not great.

Meters should be located in such a place that they can be conveniently read and installed; bathrooms, dark cellars, proximity to moving machinery being avoided.

Some Companies specify that a meter board of suitable size to take entrance box, meter and main cutouts be provided in cases where the entrance switch and main cutouts are not situated in recessed cabinets.

The type of installation used by a member-company is shown in the illustration showing the use of meter mounting board within one case the extension terminal chamber, and in the other the condulet fitting used in connection with the sealed entrance box.

In apartment blocks the location of all meters at one point in the basement is favoured. To avoid mix-up of loads, all circuits should be very carefully tested out and marked, and no changes allowed to be made except by authorized employees.

With power customers the location and installation of meters also requires careful supervision. They must be located in safe positions where they will not be subject to dampness, dirt, vibration, magnetic fields or extremes of temperatures.

When mounted on the customer's switchboard, the wiring at the back of the board should be accessible and not mixed up with high voltage circuits. Where the manufacturing process does not allow freedom from dampness, the meters are most conveniently located inside a box. The type of box used by one member-company is shown in the illustration. This installation also provides short circuiting test switches for the current transformers which are now becoming a feature of power meter installation.

One member-company finds it of advantage where instrument transformers are installed to mount meters on a separate meter panel, which can be conveniently made up of ebonite asbestos. This panel carries meters, secondary wiring and testing links, and is shown in illustration. It can be located in a position which is away from wiring carrying high voltage or high current circuits.

INSTALLATION TESTS

An opinion was asked from member-companies on the value of some form of checking the accuracy of meters after they had been replaced in service, having in mind the possibility of damage during handling.

For house service type meters it is generally considered satisfactory if the meter is correctly connected to measure the load and rotate in the correct direction. The meter installer makes the test before leaving the premises, and in most cases checks the starting load of the meter by means of the smallest lamp available on the customer's premises.

One Company reports that a special 10 watt load is used by the installer for testing starting current, and that a rough test is made by means of a 40 watt lamp, timing two revolutions of the disc with a stop watch. The result of this test is entered on the connection slip and checked by the meter foreman. They consider the results obtained warrant such a test for house type meters. The general opinion, however, that the cost of any more elaborate test than that of turning on a lamp by the meter installer is not warranted.

With meters measuring larger loads and with polyphase power installations, opinion is in favor of a complete check and inspection shortly after installation. The test is made by cutting in portable standards, using the

customer's equipment as a load. The importance of the loads metered usually warrants the employing of special meter testers for this work.

The inspection should include a complete check of the correctness of the wiring, and if instrument transformers are used, of phase and polarity.

One Company reports successful use of a small sensitive D. C. ammeter and a dry cell as a means of testing for transformer polarity. The ammeter

DIAL TESTING, AND STORAGE RACK

is connected across the secondary terminals and current from the battery applied to the primary making and breaking to obtain a kick on the meter.

Then if positive of ammeter and battery are applied to the terminals of similar polarity, on making a positive kick of the ammeter will be noticed and on breaking a negative kick.

The best check on correctness of wiring is the actual follow through of the wires from line to load, and installations should be made so that this can be readily done.

Coloured secondary wires are found of great help in tracing out wiring, and their use is recommended. An established order of colours should be adhered to, and if this can be combined with a standard phase rotation as R. W. B. it will be found of great advantage.

Some Companies are installing testing links in the secondary wiring of all primary metering installations, and for large installations where frequent tests have to be made such testing links are a necessity. Several such testing blocks are on the market or may be conveniently made up according to individual requirements. By their use the current transformer secondaries can be conveniently short circuited and the testing instruments installed without in any way disturbing the wiring. Such a testing block used by a member company is shown in the illustration. This block may be enclosed in a box and sealed against interference.

Such test blocks are also very convenient for testing by means of phantom loads when it is necessary to make a more complete test than is possible with the customer's load alone.

CHECKING METER REGISTERS

The question of incorrect or inaccurate registers being used on meters is one which is occasionally met with and large errors may be introduced which are not discovered by the ordinary revolution test of the meter disc rotation. From the information gathered, it is found that most member-companies have experience of such errors, but that they are limited to a very few in each individual's experience.

One large user of meters finds that such cases are so rare that they do not consider the expense of making a register check is warranted. Other member-companies make a check on all new meters, by comparing a specified number of disc revolutions with the dial constant against the small test dial. This check is, however, not infallible, as in the case of some meters the test dial is geared back instead of being part of the main train.

One member-company reports that they check all new meter registers before they are sealed. When meters have been tested and calibrated they set all dial hands to zero and connect 25 meters in series and apply 50% load for four hours. At the end of the four hour period the readings of each meter is checked. If one registers different from the others it is taken off and checked. They report that they have never found a case of a wrong dial, but that an occasional one has been found not registering.

In any case, it would seem that all new meters should receive examination from one familiar with the special type with regard to train marking and gearing combination. One manufacturer reports with regard to their meters that in the ordinary sizes of meters variation in hole positions makes incorrect combinations of gears practically impossible.

Errors in dials are, however, possible, especially when multipliers of 10 or 100 are used, and such meters should be carefully checked, more so as the errors if allowed to slip past are of large magnitude.

METER NUMBERING SYSTEMS

Information regarding the methods of keeping meter records as used by our member-companies has been gathered together. All records are necessarily based upon a system of numbering meters, which system may be classified under one of the following heads:—

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.

Inspection No. .... **ELECTRICITY**

Owner ....

Maker .... **Maker's No.** ....

Type .... **Amperage** .... **Voltage** ....

Wire .... **Phases** .... **Cycles** ....

DATE OF TEST	ERROR			P. N. BOOK	REMARKS
	C	%F	%S		

Disputed tests are to be entered in Red Ink.

L. 28. [illegible]-12-28.

DEPT. OF ELECTRICITY METER RECORD CARD

(a) Manufacturer's serial number.
(b) Company's own number.
(c) Government test number.

We find that the scheme of combining (b) and (c) is now being most generally adopted and this is also favoured by the Government Inspection Department. It must be borne in mind, however, that the Department is interested primarily in the seal date, and the numbering system to be so used must be such that it does not complicate their records.

One member-company by means of letter prefixes designates the type of meter as A is 5 amp., B is 10 amp., C is 15 amp., etc. V is 550 volt, X is 220v., P is polyphase. A 5 amp. 110 V. single phase meter would be designated A-serial number; a 10 amp. 220 V. polyphase B.X. serial number; a 10 amp. 550 V. B.X. serial number; and a 10 amp polyphase meter B.P. serial number.

Another Company differentiates between lighting and power meters by an affix L or P followed by the capacity in 50 watt lamps for light meters and in amperes for power meters.

So that 31,215 L 10 is a 5 amp. lighting meter
248 P 80 is an 80 amp. power meter.

When the records are kept by a company number differing from either (a) or (c) the individual record should refer to these for checking purposes.

It is then usual to keep two sets of records, one the meter history record filed by meter number giving reference to name plate data, seal date, test

data, where installed with in and out readings, and the other the consumer record giving reference to the number of meter installed with in and out readings and details of load, which record is filed by street number and may

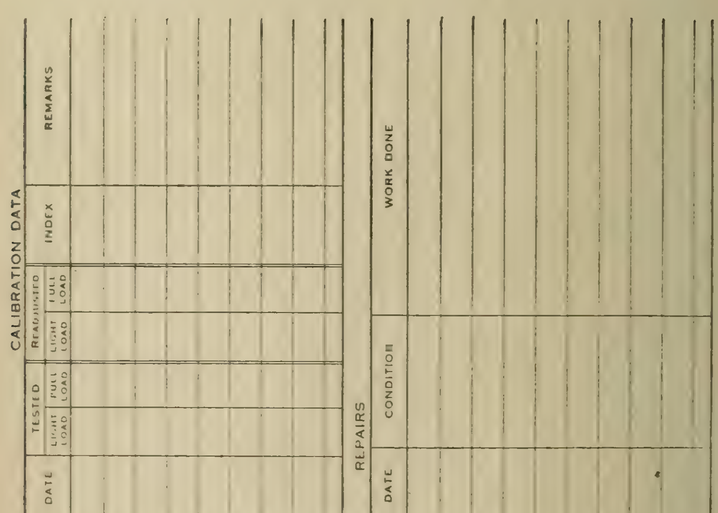
METER

SEALED
MAKE ....
STYLE No ....
SERIAL No. ....
AMP. ....
VOLTS ....

No ....
TYPE ....
DATE PURCHASED
CYCLES ....
K-CONSTANT ....
PHASE ....
GEAR TRAIN FOR ...... CURRENT TRANS.
...... POTENTIAL

ONE DIVISION OF LOWEST (NO TEST) DIAL EQUALS ...... K.W.H.

DATE	METER RECORD		POT RATIO	CURRENT RATIO	REMARKS
	ADDRESS	NAME			



METER RECORD CARD USED BY MEMBER COMPANY
Front and Reversed Sides.

be kept by the Commercial Department. It is recommended that for purposes of general information the meter history record should contain the results of tests made on meters both after bringing in from service and before resuming further service.

Some member-companies find it of advantage to keep the individual meter history records in the form of a folder or envelope in which all test results and data referring to that particular meter are placed. Different methods are used of affixing the meter number to the meter itself.

Where a sufficient number of meters are handled the Company's name plate is found most satisfactory. Provision has been made in design of future meters for space on the cover of the meters so that the owning Company can attach their own name plate if so desired.

One Company paints the number on the meter case, stamps it on the cover and marks on the dial so that there is no chance of getting the different parts mixed in the repair shops.

Small metal tags affixed to the seal wire or under the cover wing nuts are reported as being used with success. Gummed on and shellaced paper numerals and legibly painted on figures are found satisfactory by other Companies. Numbers written on the dial face with indelible ink of a very distinctive color is a scheme also adopted.

MEASUREMENT OF MAXIMUM DEMAND AND SPECIAL CONTRACT CONDITIONS.

The practice of billing a consumer upon a demand as ascertained by a periodical test is now being generally discontinued in favor of billing upon the reading of maximum demand meters. The earlier type of lagged watt hour demand meter was open to several objections by reason of the principle of its operation. The readings with rapidly varying load or with peaks of short duration differed from those where the load remained steady over a longer period.

The thermal demand meter, the operation of which is the same as the heating and cooling of the apparatus supplying the power, has been largely used and found very satisfactory, more especially as its cost allows of it being installed on small loads and that by using the auto transformer attachment the readings may be obtained in kilovolt amperes.

Indicating watt hour demand meters operating on the definite time interval principle are also being used and have the advantage that both demand and watt hours are recorded on the same meter and that the time interval can be of such duration that it is suitable for the load conditions.

It is advisable in making contracts that the type of meter to be used for measuring the load be kept in mind or that the contract be worded so that the charge may be based upon the reading of an "Approved type of Maximum Demand Meter," and "approved" may be interpreted as being a meter submitted to and accepted by the Electricity Inspection Department.

For loads of larger magnitude the graphic wattmeter is favoured, as such gives a complete record of the nature of the load and duration and frequency of peaks.

In cases where power is sold on a double rate basis with different charge for K.W.H. above a certain load, the computation is made from graphic watt meter charts. The graphic watthour demand meter based on the definite time interval principle also can be used for this purpose. The demand for

any form of excess power meter does not at present appear to warrant the manufacturers producing such an instrument.

Off peak power is similarly measured by graphic meters or by readings of watthour meters taken at the change over time. Time switches can also be used to switch over from one meter to the other, but we have not met a case amongst our membership of their being so used.

MEASUREMENT OF K.V.A. AND P.F.

The science of metering, so as to properly take care of the increased cost of supplying power to a consumer whose load has a poor power factor has made considerable progress during the past year.

The methods published in previous reports of your Committee of connecting two meters, so that from the ratio of their readings a figure for the power factor is obtained, has applied very successfully in the past. We know that by properly wording contracts and using one of these metering methods, the amount of power or energy taken by a customer with a poor power factor equipment can be increased in a justifiable manner.

The consumer seeing his bill so adjusted by a multiplying factor greater than unity and knowing that this is because of low power factor and having explained that this factor can be lessened by properly selecting equipment has come to the point of appreciating poor power factor.

Reactive voltampere meters which measure directly the out of phase component, which is the cause of the low power factor, are now available.

K.V.A. meters which measure directly the product of amperes and volts independently of their phase relationship are also available to measure with sufficient accuracy for commercial use.

Basing charges directly on K.V.A. or upon a combination of K.W. and reactive K.V.A. would now seem to be desirable as any of these quantities can be directly measured.

Their relationshp with a constant load in K.W. for various P.F.'s is as shown below:—

P.F.	K.W.	R.K.V.A	K.V.A.
100	100	0	100
90	100	49	111
80	100	75	125
70	100	102	143
60	100	133	167
50	100	173	200
40	100	230	250

Member-companies should take full advantage of these instruments, and the advantage which they give of definite measurement of quantities upon which the charges may be based.

Reactive volt ampere hours (R.V.A.H.) are measured by watthour meters by making the current in the potential coil to be in phase with the potential instead of lagging 90° as when connected to measure watthours. S in O being equal to Cos (90°—O) the registration is then equal to reactive volt-amperes (V.I. sin O) instead of watts (V.I. cos O).

This 90% lead is obtained by means of auto transformers, reactances or suitable taps on potential transformers. (For complete diagrams on all methods, refer to N.E.L.A. Meter Committee Report 1921-1922).

R.K.V.A. & K.W. hour demand meters operated by the same timing mechanism give very complete records of characteristics of a load.

K.V.A. meters are constructed upon the principle of the lagged meetr described in the 1918 report of your Committee, the potential being lagged by means of an auto transformer.

Such a meter records K.V.A. accurately on balanced loads at the particular phase shift selected and sufficient accurately for commercial purposes over quite a large angular range on each side of the selected phase shift and for unbalances usually met with. It has the advantage that if correctly connected its indications will never be greater than the true K.V.A., but care must be taken that the phases are in correct relationship. This principle applied to the thermal type of demand meter provides a low priced instrument suitable for general application on loads of small size.

Another type of K.V.A. meter allows the potential to rotate into phase with the current so that the torque on a rotating disc is aways a maximum.

Other types are mechanical combinations of watt and reactive V.A. elements so arranged that the registration is equal to the square root of the sum of the squares of these two quantities or the hypothenuse of the right angled triangle.

It is to be noted that R.K.V.A. are definite quantities in phase similar to watts and may be arithmetically added together. This makes the obtaining of combined power factor of several circuits a question of measuring sum of R.K.V.A. and sum of K.W. in these circuits.

$$\text{Then } \frac{\text{sum of R.K.V.A. meters}}{\text{sum of K.W. meters}} \text{ tan O. Cos.} = \text{P.F.}$$

In applying any of the methods of measuriag R.K.V.A., care should be taken that the meters are adjusted to measure in direct units or else that the proper multiplying constant which goes with that particular method is used.

METER TEST DEPARTMENT EQUIPMENT

The following is offered as suggestions to those member-companies desiring to provide means of carrying out tests and adjustments on meters brought in for reseal, or being first put out in service. In respect to testing tables, it may be found more economical to purchase these from one of the Companies specializing in the manufacture of such equipment.

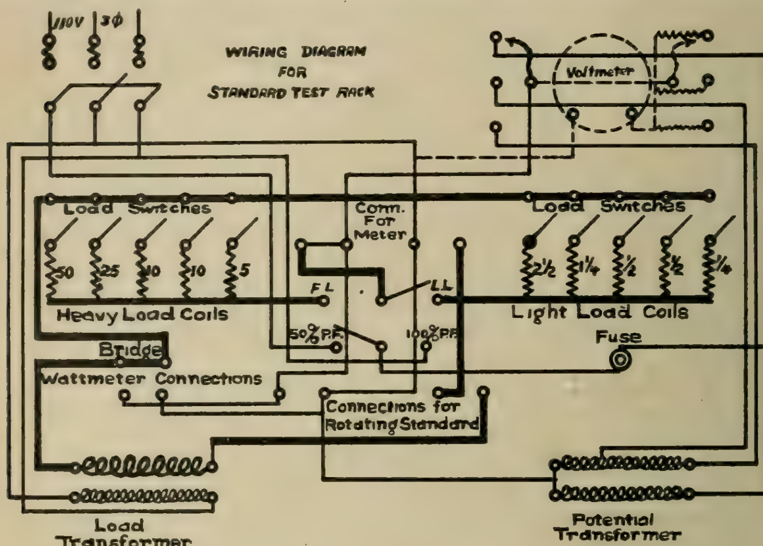
The equipment of any operating company, in so far as it affects meter work, should be separated distinctly between meter department working equipment and laboratory equipment.

Present practice, with the almost universal use of rotating standards, places under meter department working equipment, testing racks and rotating standards only. All secondary standards, primary standards and auxiliary apparatus are laboratory equipment.

When the equipment is considered as separated in this way, the minimum equipment of a meter department is a unit, which may be built by the

addition of successive units to take care of increased load on the meter department, while leaving the original unit at its full efficiency.

This principle can be economically disregarded only by the Company which in its initial equipment must plan for a large handling capacity, when the centralized control of testing units results in large economy. It requires

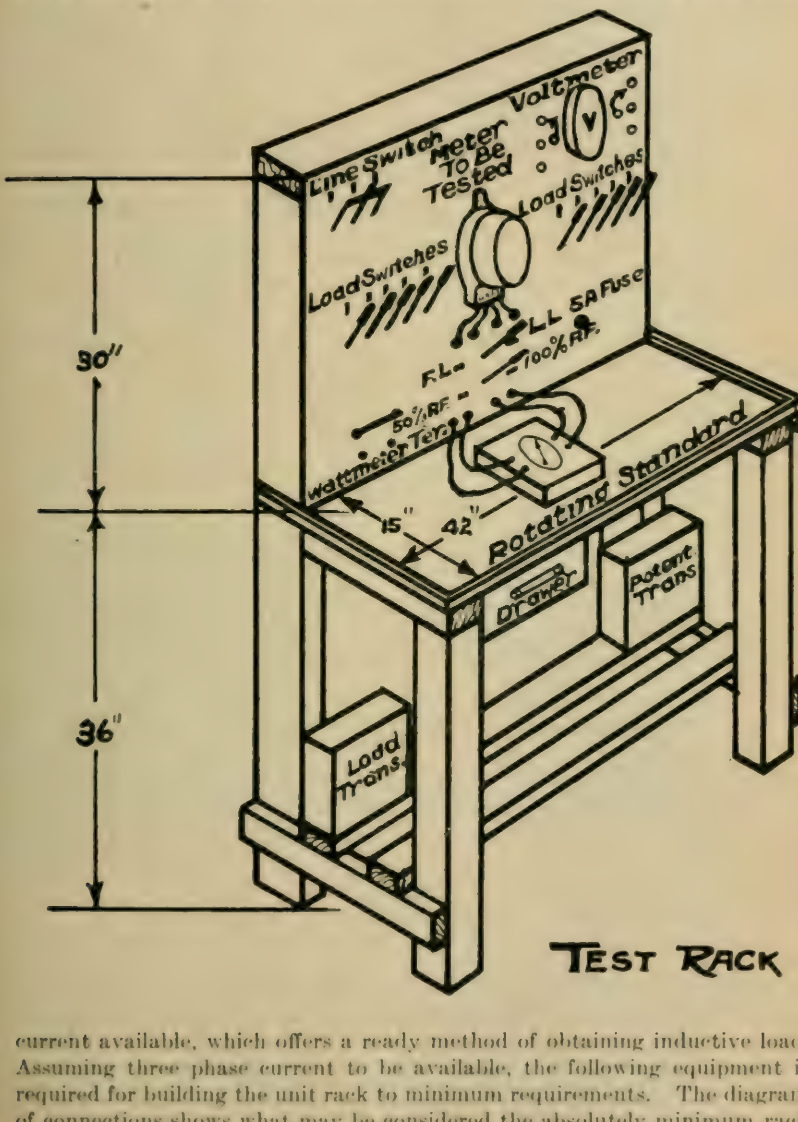


Material Required	
No.	Description
1	Load Transformer 110 V Primary 200 A 6 V Secondary
1	Pot Transformer 110 V Prim. 100 VA 110-220-550 V Sec.
1	Switch 3.P.S.T. 30 A 250 V back conn. Fused
1	" 1 P.D.T. 100 A 250 V " "
1	" 1 P.D.T. 30 A 250 V " "
1	" 1 P.S.T. 60 A 250 V " "
4	" 1 P.S.T. 30 A 250 V " "
5	" 1 P.S.T. 30 A Battery
6	Heavy Terminals
12	Potential Terminals
10	Load Coils
1	Plug Fuse Refillable
1	Voltmeter (Optional)

close to 75 meters per day to make the use of centralized control more economical than unit control, but the other advantages of centralized control would make it advantageous to any company having a peak load of 75 meters or more per day, during certain seasons of the year.

Reverting to the unit testing rack system, which is the system most desirable in the majority of cases, experience has shown that the load transformer type of rack is by far the best. For ordinary commercial work, power factor

control is unnecessary, any method of obtaining 50% power factor is sufficient. Phase compensation is a fixed adjustment so far as varying power factor is concerned, and any present day meter correctly compensated at 50% power factor will without question be properly compensated at other power factors up to unity. Nearly all member-companies have three phase



TEST RACK

current available, which offers a ready method of obtaining inductive load. Assuming three phase current to be available, the following equipment is required for building the unit rack to minimum requirements. The diagram of connections shows what may be considered the absolutely minimum rack

together with sketch showing general dimensions and appearance of rack as found to be most satisfactory.

For meters of capacity 10 to 100 Amp. 110-220 or 550 volt, single or polyphase.

1. Rotating standard.
2. Potential transformer, 110 volt primary, 220 volt or 550 volt secondary, of 100 watt capacity. This transformer, of course, not required if all voltages necessary are available from line.
3. Current or load transformer, 110 volt primary, 200 Amp., 4 or 6 volt secondary. In standard designs available, the 25 cycle design is desirable, even for use on 60 cycle, as its characteristics are considerably better.

4a. Load switches of battery type for ¼ to 25 Amp. load and standard knife type for 50 Amp. up.

b. One three pole single throw fuse switch for control of rack.

c. One single pole double throw, 100 Amp. knife switch for load control light or full load.

d. One single pole double throw, 30 Amp. switch for potential inductive, to non-inductive load.

e. Fuse plugs and fuse blocks for potential lines to rack.

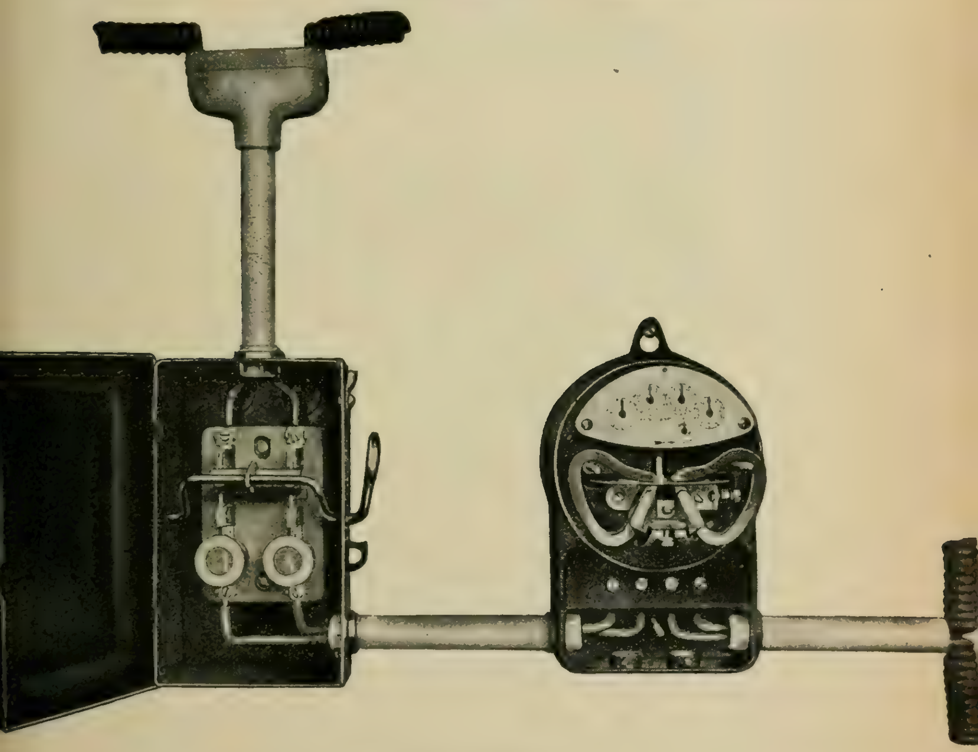
5. Resistance wire as specified for making up load from light to full All load capacities in the secondary of the current transformer.
6. Optional—Volt meter wall type with multipliers automatically shifted by volt meter plug. This may be added to the minimum unit at any time.
7. Optional—Carbon rheostat load control. This also may be added at any time, and is desirable when the company reaches a point in its equipment where it has watt meters and stop watches, and uses these as secondary standards for checking rotating standards.

NOTES ON UNIT RACK AS RECOMMENDED

1. Standards should preferably be installed on shelves, set under the working table, and with the top projecting a few inches above the working top of the table.
2. If construction of the standard permit, it is desirable when the standard is installed for a day's work to change the ranges for the meters of different capacity, by means of switches rather than shifting the connections at the standard.
3. Load resistances can be made up for the track with standard resistance wire. For light load where a considerable amount of resistance is required, a most satisfactory way of making the loads is to wind the resistance wire non-inductively on cartridge fuse casings.
4. Provide a high chair with supports for the lower part of the back, and a foot rest. The work done at the rack between the hours of 3.30 and 5.30 in the afternoon will be faster and better.
5. Limit the rack dimensions to a reasonable size for handling one meter at a time. More is wasted space and tends to slovenly habits on the part of the operator.

6. Furnish a draw with a lock for tools, and encourage the meter tester to accumulate his own set of small tools, such as pliers, tweezers, jeweller's glass, etc. A meter tester, like a tool maker, does better work with tools he has selected himself, and which he owns.

The company which can have the minimum equipment only will usually have to rely on Government check on his rotating standard. Undoubtedly the first step, so far as laboratory equipment is concerned, is the purchase of a good medium range watt meter, and two (2) stop watches of as reliable a type as are available. A single wattmeter furnishes a very satisfactory means of checking a multiple range rotating standard, as it permits exact



IX 14 METER

checking of all the lower ranges, and the construction of most rotating standards is such that a check on the lower ranges is the equivalent of a reasonably accurate check on all ranges.

In regard to additional secondary standards, primary standards, and all other laboratory equipment, the question is a matter of individual requirements, resources, etc., and is impossible of generalization.

LOAD COILS FOR TEST-RACK.

Approx.—depending upon individual transformer–Driver Harris No. 301 Alloy, 6 Volt Tube.

50	Amp.	5 strands	No.. 18—20″	approx.
25	"	3 "	No. 18—24″	"
10	"		No. 18—50″	"
5	"		No. 22—36″	"
2½	"		No. 28—6′	"
1¼	'		No. 28—11′	"
½	"		No. 28—26′	"
¼	"		No. 28—56′	"

NEW DEVELOPMENTS.

The following new developments in meters and metering equipment have been brought to the attention of your Committee during the past year. The equipment noted is stated by the manufacturers to be available for use in Canada.

Packard Electric Co. have developed a line of combined potential and current metering transformers. This is, as the name implies, a combination of potential and current transformers mounted in one oil-filled weather-proof tank, the whole comprising a piece of equipment suitable for metering power on lines where the voltage is 2200 V. or higher.

Lincoln Meter Co. have perfected their V.A.D. transformer by which any Lincoln demand meter may be converted into a K.V.A. demand meter. Reports received from member-companies state very successful use of this device. They have also developed a split-core transformer and Lincoln Demand ammeter which makes it possible to very easily check the load on a transformer bank without disturbing the connections.

Canadian General Electrical Co. have developed the I. 14 X meter which is a modification of the I 14 standard watthour meter. In this meter provision is made for the metal conduit to enter the lower terminal compartment of the meter. This does away with meter service cabinet trims and amply protects the meter terminal connection against tampering and resulting theft of current, and being part of the meter, gives a compact and neat installation.

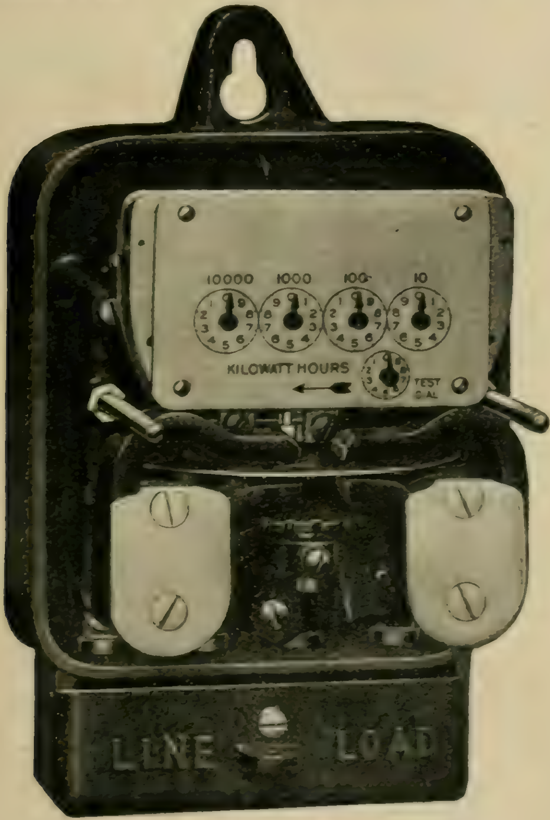
They also report that space above the manufacturer's name plate on terminal cover allows for Company's name plate, which may be attached at factory if so desired.

Canadian Westinghouse Co. expect very shortly to put on the Canadian market a polyphase watthour meter with a maximum demand register. This will work on the definite time interval principle and will give indications of both maximum demand over the interval and of the K.W. hours. The timing device is a small induction motor which will have a practically constant speed over a range of voltage from 90% to 110% of rated. The maximum demand register is provided on special meters and is not interchangeable with standard registers made by the Canadian Westinghouse Co. for other meters.

Sangamo Electric Co. have developed their type S. meter to fill the demand for a smaller and somewhat less expensive meter than their well-known type H. They do not claim that this meter is in all respects the equal of

their type H., the torque being lower, but the details of design, bearings, magnets, recording train and workmanship are all of similar quality to that put in the type H.

This meter follows the Sangamo principle of the moving system, light load adjustment, permanent magnets and recording train all being carried on a light cast iron grid, which is removable as a unit. All adjustments are of the micrometer type.



SANGAMO TYPE S METER

The meter is offered in capacities of 10, 15 and 20 amps., 110 or 220, 2 or 3 wire.

The cover is being constructed to allow space for attachment of Company's name plate.

RESUMÉ OF N.E.L.A. METER COMMITTEE 1922 REPORT.

EDUCATIONAL COURSES FOR METERMEN.

Outlines for various instructive courses for metermen are given. These courses are graded so that suitable ones may be selected to suit both the beginner and the more advanced metermen.

STANDARDIZATION OF METER AND INSTRUMENT DESIGN.

Various details in the design of metering equipment are reported upon including direction of rotation of moving element of watthour meters; space for serial numbers on metal covers of watthour meters; standardization of terminal chambers; potential switch for rotating standard testing and bottom connected D.C. watthour meters.

INDOOR TYPE INSTRUMENT TRANSFORMERS USED ON CUSTOMERS' INSTALLATIONS.

A summary of recommendations covering connection diagrams, polarity markings, leads and terminals, name plate, data, standard dimensions, etc., have been drawn up. The manufacturers concurred in the production of this report.

REVISION OF METERMAN'S HANDBOOK.

The revision of the Handbook is being proceeded with and it is expected that the revised edition may be available by January 1, 1923.

COMMISSION RULINGS.

Various commission rules are reported upon.

MORE RAPID METHODS OF TESTING INSTRUMENT TRANSFORMERS.

Methods available are reported upon.

K.V.A. AND POWER FACTOR MEASUREMENT.

A very progressive report on the above subject is presented, various new methods and instruments being described. A valuable paper on the Analysis of Economic Losses due to Power Factor and Basic Meterable Factors was presented at one of the sessions of the Convention.

MAINTENANCE OF SWITCHBOARD METERS, INSTRUMENTS AND RELAYS.

This was new ground for the Committee and the first report presented this year describes instruments and methods which should be of great value.

REVISION OF METER CODE.

The revision of meter code is being proceeded with.

Respectfully submitted,

E. HOLDER, *Chairman.*	E. G. RATZ.
E. J. TURLEY.	SCOTT LYNN.
P. S. GREGORY.	M. C. SMITH.
E. R. SPENCE.	J. I. NEWELL.
S. L. B. LINES.	

E. HOLDER:—You all have a copy of this Committee report, so I will just refer to some of the clauses which might be discussed.

The meter seal extension question was covered in the Secretary-Treasurer's report, and nothing further need be said, except to ask that the forms sent around be returned promptly. We want all the information we can get on this subject, the more the better.

PRESIDENT:—In this matter of meter seal period, we were to supply the Minister with our data to try to demonstrate that our statements regarding the percentage of bad meters was what we said it was. Since

this report was made or presented, several months have elapsed, and we have data now on several thousand additional meters. Can you tell us whether the data does check up now?

E. HOLDER:—We received some data for the year 1921, copy of which has been forwarded to the Minister, which checks up well with the report given last year, that is the figure of 94 per cent. of the meters maintaining their accuracy holds.

We have also received some data for the year 1922, but not yet complete enough to say if the figure is still holding up, although I see no reason why there should be any drop.

Re the question of Meter Standardization. We had a meeting in August with the Watthour Section of the Canadian Engineering Standards Association, and that meeting was attended by the manufacturers, by the different meter users, and also by the Director of the Department of Electricity Inspection. We discussed a preliminary draft specification, and the discussion is having a good effect. Manufacturers are introducing features of design on their meters which it was the opinion of the meeting should be done. Since drawing up our report the Director of the Inspection Department has been working on draft rules for the inspection and testing of meters under the Inspection Act, and he also is falling in with preliminary specification we drew up. The work has been held up, because the Chairman of the Section, Professor Gill, moved to Vancouver. We expect to have some meetings this year if Professor Gill is again available.

We went into the question of Handling of Meters. We decided that the number of meters proving inaccurate after they had been out for a short time (sometimes less than a year) is far too high. We decided this is due to bad handling. We have some recommendations regarding handling of meters, which, while not very full and complete, we thought would be a good idea to draw to the attention of the members of the Association. We cannot exercise too much care in handling meters after they have been tested. We spend money on having meters tested and sealed by the Government Inspector. If those meters are to be handled badly in taking out of the test room and installing on the customer's premises, this money is wasted.

We devoted some time to the question of Installation of Meters. This is not given, in our opinion, enough attention, especially in the Province of Quebec. We see meters installed in all kinds of ways and places, sometimes absolutely inviting the stealing of current. There is nothing worse than to go into a house or store, or other place, and see the wiring to the meter in poor shape. It is a thing which reflects on the power company, and is not good practice anyway.

We also took up the question of installing testing facilities in the power meter circuit. That is a thing we consider very important. The power meter is a thing which does require checking. If you have facilities for checking, the work can be done easily and cheaply. The chief trouble is incorrect wiring. We think the use of coloured wires facil-

itates the checking out of power meter installation, and enables the thing to be put in correctly. Some consideration is given to testing lighting meters, to see if meter is damaged during handling, and we offer some information on this subject. General opinion seems to be that with the lighting meter it is not necessary to make an elaborate test.

Checking Meter Registers.—There are some cases where incorrect registers get on meters. Every meter man can tell you of a case in his own experience where that has occurred. Incorrect meter dials will get past a series of tests.

Meter Numbering Systems.—Keeping meter records, and in turning in of such records, should be based on some kind of numbering system.

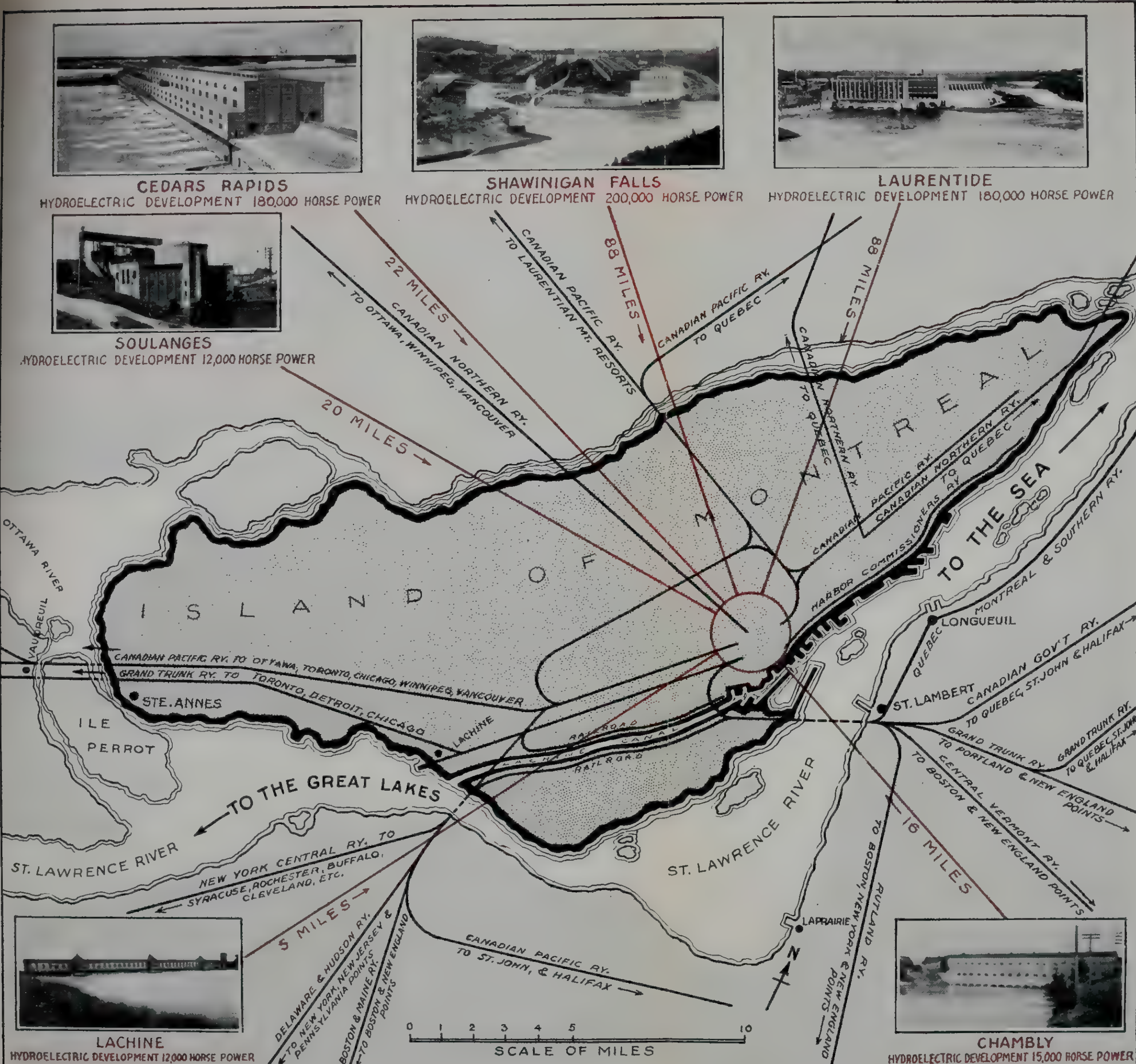
Measurement of Maximum Demand.—This is a matter which connects in with the work of Power Sales Committee. In making a contract, it should be clearly stated what the conditions of metering are. The meter man should be consulted in making up contract, so that he can say whether the conditions that are stated in the contract can be metered. That is a very important point that you should consider, the metering, before you make the contract conditions.

Then comes the question of measurement of KVA and Power Factor. We are getting quite a number of instruments for measuring KVA. The Lincoln VAD transformer has proved satisfactory for small loads, and meters can be obtained. The measuring of reactive KVA has developed. Making a direct charge for reactive KVA might be considered in place of imposing penalties for low power factor. In paying directly for reactive KVA, consumer would be paying for something for which he is getting value.

We give a description of Meter Department Testing Equipment, which we think might be useful for smaller companies. This describes testing racks and resistances, and such like, which can easily be made up.

We give resumé of the N.E.L.A. Committee Report. I myself attended three meetings, and assisted in the work of preparing this report. I would recommend that everyone interested in the question of metering obtain a copy of this report and read it through. There are some things in it which have never before been published. It is worth while reading through thoroughly. (Applause)

R. J. DURLEY:—I am Secretary of the Canadian Engineering Standards Association. Professor Gill was in my office the other day, and he asked me to come and say he was sorry he would not be here, and also to tell you that we are arranging for the work of the sub-committee to proceed almost immediately. He has given me a little memorandum about it, most of the information on which Mr. Holder has already given you. Revision of the draft specification is being proceeded with in accordance with suggestions which have been sent in by various members of the sub-committee. We are to arrange for the next meeting of the sub-committee within the next month or six weeks, so that the work is being actively proceeded with.



MONTREAL AND DISTRICT
SHOWING UNRIVALLED TRANSPORTATION AND HYDROELECTRIC POWER FACILITIES

PRESIDENT:—Gentlemen, this is a matter of great interest to us all, and I think very few people who have not given it a good deal of thought realize the importance of some of the points made by Mr. Holder that are mentioned in this report. One would suppose that question of connection of meters, particularly polyphase meters, was so well known that there could not be errors made, and yet I dare say there is quite a large percentage of errors made in connecting up polyphase power meters actually in service. The reason is, that when connected in, power factor to customer's load may be low,—may be less than 50 per cent.,—and the man who goes out and connects meter up connects it up to run in one direction. If he happens to have a circuit to which the power factor is below 50 per cent., he will get probably connections reversed every time. This actually happens. Mr. Holder could name a good many instances where he and his men have checked up installations made by the Operating Department and found errors. I know myself of one important installation where two single phase meters were put in. We had a good deal of trouble to demonstrate to the people involved that the meters were incorrectly connected. I only mention this to show that even to those of us who are supposed to know this subject well, it is one that needs attention.

L. W. PRATT:—I am sorry I did not hear Mr. Holder's resume of his paper. I attended an important session of Mr. Onken's committee last night, which extended far into the night. That is my alibi for being late.

The report of the Meter Committee for this year appears to be so thorough and authoritative on the subjects necessarily limited by the scope of a Sectional Committee that it offers little opportunity for criticism and gives evidence of so much consideration in committee that the Chairman has felt it necessary to arrange beforehand for someone to start the discussion. I therefore do so with a certain amount of trepidation, and will pass quickly through the report, raising a few points which may be conducive to thought and discussion.

Meter Seal Period.—May I add my small quota in the way of recommending that a strong and influential deputation wait on the Minister during the coming session, or such session as may be deemed advisable to attend, accompanied by a spokesman who is well versed in the procedure necessary for handling a situation of this kind?

In connection with the information which was asked for by the Committee Chairman, Mr. Holder, I find on looking up the report of our Company for the year 1921, that only two meters of the total number brought in for test and reseal or for any reason whatever were over 3 per cent. fast, and these two particular meters had been out less than two years. In fact, from an analysis of the reports which we make from time to time, it would appear that, like good wine, our meters improve with age, the longer they have been in service, the less likely they seem to go wrong. We have had them come in, sometimes through mistakes in numbers—meters which have been out for ten years, and they are invariably registering in favour of the customer.

Handling of Meters.—I cannot refrain from making some remark about the method suggested for handling meters, to carry two meters at a time on a strap over the shoulder. Very often a man only has one meter to take out. Must he do as they do in Holland, put a load on the other end of the strap to make it balance?

We find a good method of transporting meters in small quantities is to use a hook wide enough to allow two meters to be carried back to back, terminating in a handle. Meters in this way at arm's length are less liable to damage than when carried over the shoulder. There is very little jar or vibration.

Meter Installation.—The selection of the location for meters in Ontario is largely in the hands of the Provincial Electrical Inspection Department, and on the whole this arrangement is very satisfactory to the companies. Occasionally we find a meter is subject to dampness, but we feel this is more than offset by the regulations which have reduced the bridging of meters by unscrupulous persons to a minimum.

We have recently demonstrated in Hamilton an Electrical Home (to which I referred yesterday) with service pipe built into the brickwork, so that the meter can readily be read without entering the house, and installed in such a manner that it cannot be tampered with from the inside without tearing down the steel service box in the basement. The photos which I have here will illustrate the arrangement very clearly.

With respect to the meter box shown on page 79. This box is used by our Company in large numbers. It is not only very useful where additional protection is needed, but very convenient in fairly large installations, and in cases where primary metering panels are not provided by the customer (as often happens where the installation has been built up by slow degrees). The short circuiting switches are installed in such a manner that the doors of the box cannot be closed when the switches are closed; being provided with double terminals, the switches make it easy to couple in a testing instrument. The switches also enable the inspector to test the meter for operation on both elements, making it easy to change the meter, and by means of special short circuiting clamps, the main primary feeds can be short circuited and the current transformer changed without closing down the customer. The arrangement is such that no matter what takes place, the Meter Department can change the customer's metering equipment without closing them down, sometimes a very important feature.

Checking Registers.—The meters passing through our Testing Department are connected from 20 to 30 series and run under full load for a sufficient length of time to test the correctness of the dials. I can only recollect one case where we had a meter operating with a wrong dial and this was not found out until the customer made a complaint that his new and correct meter was registering twice as much as the old one.

Maximum Demand.—I would suggest that contracts be not only worded in such a way that improved type of instruments can be in-

stalled, but that the Company should have option of installing either maximum demand or graphic meter. There are some cases where a graphic will better answer the purpose, and others where thermal demand or meters of that type are more suitable.

Great care should be exercised in determining peak interval on graphic meters. The two charts which I have here will illustrate the need for caution. In one case the Company would not suffer with a 30 minutes interval, and in the other case 5 or even 3 minutes would be too long.

In connection with *Measurement of Kilo Volt Amperes:* If the customer's average power factor is regarded as a satisfactory basis, this can readily and simply be obtained with two watt hour meters, the wattless component meter being connected with cross phase voltage.

Meter Test Equipment.—An idea in connection with meter testing equipment outlined in the paper, which is particularly good for protecting rotating standard, is to cut plate glass window in top of the bench and set a rotating standard underneath. You then have a clear working surface for meter tester, and the rotating standard is out of harm's way.

New Developments.—I would like to know if it is the intention of the larger manufacturing companies in Canada to modify their designs so that the wires from the service box can enter the terminal box in conduit. I notice in the N.E.L.A. report that the General Electric Company are using open terminal type of construction with removable terminals. This is a great advantage to the meter repair man. We find the terminal box filled with insulating compound is a fruitful source of trouble. It is only in the last few years that manufacturing companies have adopted the compound filled terminal box in order to cut down the cost. For my part, I feel it is a move in the wrong direction.

N.E.L.A. Report.—I am glad to see that the parent committees are making strong recommendations as to the standardization of meter transformer dimensions, making connections clearer, and including in such diagrams identification of the polarity markings. This is a detail which the manufacturers seldom make clear in their connection diagrams or instruction books. How many meter installers know that the marked pair of terminals on a current transformer, for instance, will be the same as if the primary service conductor itself were detached from the transformer and connected directly to the secondary conductor?

Another important point is that the polarity markings on these instrument transformers should be supplemented by some physical way, which should not be obliterated when transformers are repainted, as they often are.

I would strongly recommend to all member companies that they procure sufficient number of copies of the "Lecture on Meters," issued by the N.E.L.A. Meter Committee for free distribution to their meter department staffs. The cost is only nominal, 10 cts., and all meter men would benefit by having copy of this report in their possession.

P. T. DAVIES:—(*In Chair*) :—Mr. Pratt has given us a very complete paper, a paper which needs our very careful study. Inasmuch as there are a number of contentious points, it seems to me perhaps if we segregate this discussion into sections, we might get further than by roaming around. This is our bread and butter. The meter earns all we ever get, and we have to be most careful to see that we are paid. With that in view, I would like to review it carefully, and perhaps if Mr. Holder will give me a hand on this, we could open this up for discussion page by page, if that is your pleasure.

Is there any discussion on the question of carrying meters?

E. HOLDER:—The method suggested by Mr. Pratt, of carrying two meters on strap, one against the other, is all right if the meter men exercise care, but the average meterman does not. If you can devise some scheme by which it is not necessary to watch the meter installer so much, I think that scheme is worthy of consideration.

P. T. DAVIES:—Any further discussion on the matter of carrying meters?

E. HOLDER:—I do not know how many companies are putting in meter testing links; we are putting them on all power meter installations. The scheme is explained on page 77, and the type of test block shown on page 73.

L. W. PRATT:—I would like to ask Mr. Holder if it is the practice to seal these test link boxes.

E. HOLDER:—Provision is made for sealing the box, although on most of our meters installed in sub-stations, where no one but authorized persons have permission to enter, it is not so important that they should be sealed, but they should be sealed on customer's premises.

P. T. DAVIES:—I notice you show fuses in these boxes. Are these on potential circuit?

E. HOLDER:—Yes, they are in the potential circuit. Fuses installed on the primary side of potential transformers are used to protect the system against the transformer, rather than to protect transformer against damage. If fuses were not there, there are certain cases where a short circuit might be started and serious damage to the system result.

P. T. DAVIES:—My experience (we are speaking about 2,200 volt transformers) has been that they don't cause any trouble if they burn out. Reactance of the transformer is sufficient to cut the trouble down. They don't do any great damage. Personally I am against using fuses. Fuses may blow and metering equipment may be out for an unknown period. I would like more discussion on this matter of fusing potential transformer of meters.

MR. REID:—I think primary fuses are rather important on these potential transformers, because up to the present time manufacturers do not seem to be able to produce potential transformers that stand up well. If the transformer starts to burn out, and you have not got fuses, it means a shut down. We have very common incidents on our lines

of such potential transformers. It is true that often they start smoking, but fuses can be drawn before they actually blow up. In a great many cases it would mean a shutdown on the system if there were not primary fuses on the transformer.

L. W. PRATT:—I am of much the same opinion as you are in regard to potential transformers on 2,200 volt systems. Perhaps it is a good thing for our companies that the Meter Department does not control their policies in regard to line construction, etc., but nevertheless I would feel more inclined to take a chance of damage done by the outdoor type of potential transformer to the system than to suffer the considerable losses apt to ensue on installations metered with potential transformers. We have known quite a number of cases recently where line troubles in lightning storms would result in burning off of terminals and leads to potential transformers, and burning out of the transformers themselves. So far I cannot recall any serious cases where potential transformers have been connected without fusing. Potential transformers which have been fused have in the end caused us more expense than those which have not. It is rarely that a potential transformer creates much of a disturbance if it burns out.

P. T. DAVIES:—Any more experience, gentlemen, along these lines?

E. HOLDER:—An important subject which is also in line with the work of the Power Sales Committee is the measurement of maximum demand and special contract conditions. In that connection I would recommend everyone to read the paper referred to before, by Mr. R. C. Fryer, Chairman of sub-committee on P.F. & K.V.A. measurement of N.E.L.A. on economic losses due to power factor. It goes very thoroughly into different reasons, and why we should charge for these things. I think that we might hear from some of the power salesmen on the question of metering demand power factor and K.V.A. under special contract conditions.

P. T. DAVIES:—We have to consider a difficult problem. There are two charts going around which I have not seen, but I have no doubt are the usual, one with fluctuating load of short duration and the other one with steady load. This is a problem. We have hopes that the Thermal type of meter will show the cost to the power company supplying service. It bears a direct relation to the use of capacity of the company's system, so that the charge upon Thermal demand meter is at least charging upon capacity that we have to provide to supply the load, but as to whether five minutes, 10 or 15 minutes peak is a fair method of charging, is open to great discussion. I would like to hear somebody who can elucidate at once and for all.

A. A. DION:—I do not know of any contention in the report as I read it.

P. T. DAVIES:—Mr. Ross is going to speak on this.

D. H. ROSS:—I have nothing to add, Mr. Chairman. It seems to me Mr. Pratt has brought up a lot of points which could be very intelligently discussed by the power companies. There is only one point which Mr.

Pratt brought up that I might like an expression of opinion on. That is the recommendation made regarding meter terminals that are manufactured at the present time. It has not come to my knowledge that there has been any particular trouble with compensation terminals.

E. HOLDER:—I might say that the N.E.L.A. Meter Committee seems to be in favour of meter terminals which can be removed, and that is probably the reason for the type of meter terminal used by the C.G.E. In Canada most of our terminals are set in solid. Personally, I do not see any objection to the meter terminal set in solid installation. But those of wide experience seem to be against it.

P. T. DAVIES:—Is there any more discussion on the matter of maximum demand, and particularly with regard to those charts Mr. Pratt sent around? This is a perennial question.

W. G. H. CAMM:—Can you illustrate what these charts were handed around for? I have seen the charts, but could not get the point.

L. W. PRATT:—These charts illustrate, I think the futility of endeavouring to set down any hard and fast rules for maximum demand interval, and for that reason it will always be a perennial question. There is another feature which further complicates our problems, and that is until you have made your contract with customer and supplied him with power for some time and measured his load, you don't know until then what kind of basis you are charging him on.

This chart illustrates an agricultural implement manufacturer's load. We could give this customer a maximum demand of one hour's duration and not suffer. The other chart is taken on the load of a small plate mill. As the plates go through the roll the demand goes up and the load immediately drops off almost to zero. This operation goes on perhaps for four or five hours and it is while that operation is in progress that the maximum capacity of the installation is required. At other hours of the day there is a load of a slightly different character but at the same time a considerable fluctuation. There is no question but that if we are giving this man a 15 min. peak for the highest load we would get but little over 10 per cent. of the peak on the chart. I think you will all agree that it would be necessary for the Central Station to have capacity at least to this point and somewhere about the center of the fluctuations. Consequently, this chart demonstrates that to base your charges to the customer on say, a ten or fifteen minute maximum peak as read by such a chart as this, would be very poor business, and I think that perhaps these two charts illustrate very graphically my point as to the futility of endeavoring to set a hard and fast rule for maximum demand.

P. T. DAVIES:—You don't need to apologize for charging a man for the capacity he requires. If he had his own plant he would have to have sufficient capacity in the plant to take care of these maximum swings.

W. G. H. CAMM:—Does not this question depend more or less on the definition of what you mean by a 15 minute peak? I have had this question up from time to time, and where you have a veritable load like

the rolling mill load, wouldn't you figure the 15 minute peak the average peak for 15 minutes? I would like Mr. Pratt to answer that question, whether he wouldn't take that point of view in dealing with customer like that,—the average 15 minutes maximum instead of sustained 15 minutes maximum.

P. T. DAVIES:—There is no such thing as a sustained peak in Canada.

W. G. H. CAMM:—I have come across a sustained peak and an average peak.

L. W. PRATT:—It used to be common practice to sell power on the sustained peak basis, and that is the weakness in this particular contract. I would not say that it would be unsatisfactory to sell energy to the man with the fluctuating load on a 15 minute basis, if the load averaged over the 15 minute period.

JULIAN C. SMITH:—A demand meter would cover this particular problem very nicely, but using graphic meter and selling current on your sustained peak for a definite length of time, gives the supplying company very much the worse of it on a load of this nature.

P. S. GREGORY:—There is one way that the situation can be met. In one of our contracts in connection with a big paper company, we bill the customer on 100/120ths of their instantaneous peak, which really covers the question. I think what we want to get at all times in contracts of this kind is the amount of installed capacity which the customer's load takes up. We have a certain fixed installed capacity and the demand charge covers the right to use a definite amount of that installed capacity.

E. HOLDER:—The Committee had in mind that a paragraph should be inserted in the contract specifying that a particular type of demand meter should be used. It may be thought best not to specify the type of meter, but to leave the question open, as the nature of the load may not be known at the time of making the contract. A different type of meter from that we first had in mind might be more suitable or a better type be produced. It would be well under such conditions not to tie ourselves down to the use of one particular type.

JULIAN C. SMITH:—Mr. Chairman, Mr. Holder mentioned in his report earlier, a very important thing I think this meeting should recommend through the Meter Committee. That is, the necessity of power company specifying in its contract final manner of measurement of the maximum demand. Now, if you read over many of the contracts which have been made in the last years, you will find this question of peak is different in very many contracts. Some contracts speak of the highest one hour peak. Some contracts speak of the average half hour peak. Some contracts speak of the average of the five highest peaks; and generally speaking it is very hard to decide, and very hard to measure what these contracts meant. I think that if the suggestion that came out yesterday is put into practice, that we should try to find a uniform type of contract in the first place, and second, that the

contract should embody in it a definite method of measurement, and be so worded that we will have the last argument with customer, then the customer will be better satisfied than to-day, where there is always an argument as to what the contract means.

J. B. WOODYATT:—I think that is a very important point. I think whether we give a 5 or 10 or 20 minute peak is a matter of opinion. We speak of selling power in terms of horsepower or kilowatts, and I think the first thing we ought to do is to know what we are selling, and we can then fix the rate accordingly.

L. W. PRATT:—In reference to this question of demand, personally, so far as I am concerned, I refer particularly to smaller loads. In the case of a paper mill, or anything like that, with large loads, we have to make exceptional conditions, but I refer to general small industrial loads.

J. B. WOODYATT:—I don't see why it cannot apply to all kinds of loads. A pound is a pound, and I don't see why a horsepower cannot be a horsepower, and our price arranged to suit.

P. T. DAVIES:—Well, gentlemen, has anybody got any instructive suggestions?

I would like to ask Mr. Pratt whether the steel foundry curve is a typical one, or is it one that could be made more uniform by using a fly wheel, automatically regulated?

L. W. PRATT:—That is a matter we have not looked into. The mill in question is not a very large one. I do not think their maximum demand ever exceeds 150 H.P. Consequently, we do not regard this customer's load as a very important one nor does it appreciably affect our load factor or regulation. It is probable, if the customer was five or ten times as large, we would have gone into the question very thoroughly with a view to ironing out the fluctuations. The point you raise, however, is a very timely one, and I am going to take advantage of it some time in the future.

P. T. DAVIES:—That is probably the solution of these very badly fluctuating peaks — to arrange the contract so that customer is penalized if he has them.

W. G. H. CAMM:—I would like to ask whether the matter has been considered, that the large customer is always treated on a different basis by the power companies as regards the matter of regulation. The small customer is allowed to go his own way, whereas the larger customer is regulated.

O. HIGMAN:—I think it would be highly desirable if this Association would make some arrangement in regard to the time limit of maximum demand. The attention of the Minister was called to a contract on one occasion, and indeed it was a contract in which the Government itself was involved, where the time limit was only two minutes, and the penalty in the contract was that that peak was to obtain during the whole five years of the contract. Now the peak was a most abnormal one on that occasion, going up for a minute more than double the horsepower that was contracted for, and so the Government was penalized for double

the amount that they used for five years. I am quite sure that contracts have been moderated since that time, but I think, as Mr. Smith has already said, if you can get down to a general contract, and the proper time limit in regard to maximum demand, I think a great purpose will be served.

P. T. DAVIES:—We are again wandering around this subject and passing it up for the next Convention. I have seen this thing happen several times before. It is very difficult, and I would like some more discussion now.

Mr. Pratt in his remarks made suggestion that an influential committee wait upon the Department regarding the extension of meter seals, with a good spokesman, and I feel that with deference to the Committee which did wait upon Minister, I ought to mention who they were so that Mr. Pratt will not think the matter was not thoroughly handled. The deputation consisted of Messrs. Julian C. Smith, J. S. Norris, A. Dion, R. Holder and Messrs McHenry, Scott and a third gentleman of the Ontario Hydro. The spokesman was myself.

L. W. PRATT:—I do not wish to be understood as criticizing the deputation that went to Ottawa. What I had in mind was, when the time was ripe, we should again wait on the Minister, and I am sure that the spokesman who served so well and faithfully the Association before might very well be employed in a like capacity in the future.

P. T. DAVIES:—The time is getting along. Is there any further discussion on this paper?

PRESIDENT:—Mr. Wurtele will present report of the Electrical Apparatus Committee.

REPORT OF ELECTRICAL APPARATUS COMMITTEE, 1922

During the past year the first of the large units in the Hydro-Electric Power Commission Station at Queenston was installed by the Canadian Westinghouse Company.

PLATE No. 1

This generator is rated at 45,000 K.V.A., and supplies current at 25 cycles and 12,000 volts. It is of the vertical type, with exciter mounted above the thrust bearing. The insulation of the completed armature coils is made with Micarta folium insulation, comprising a patented process.

PLATE No. 2

It is very compact, and has a high dielectric strength.

PLATE No. 3

The armature coils are arranged for star connection, and both ends of each phase winding are brought out through the frame, in order to permit of the insertion of protective relays.

PLATE No. 4

The thrust bearing is designed to carry a total load including water thrust of 1,000,000 lbs. Forced draft is use for ventilation and the,

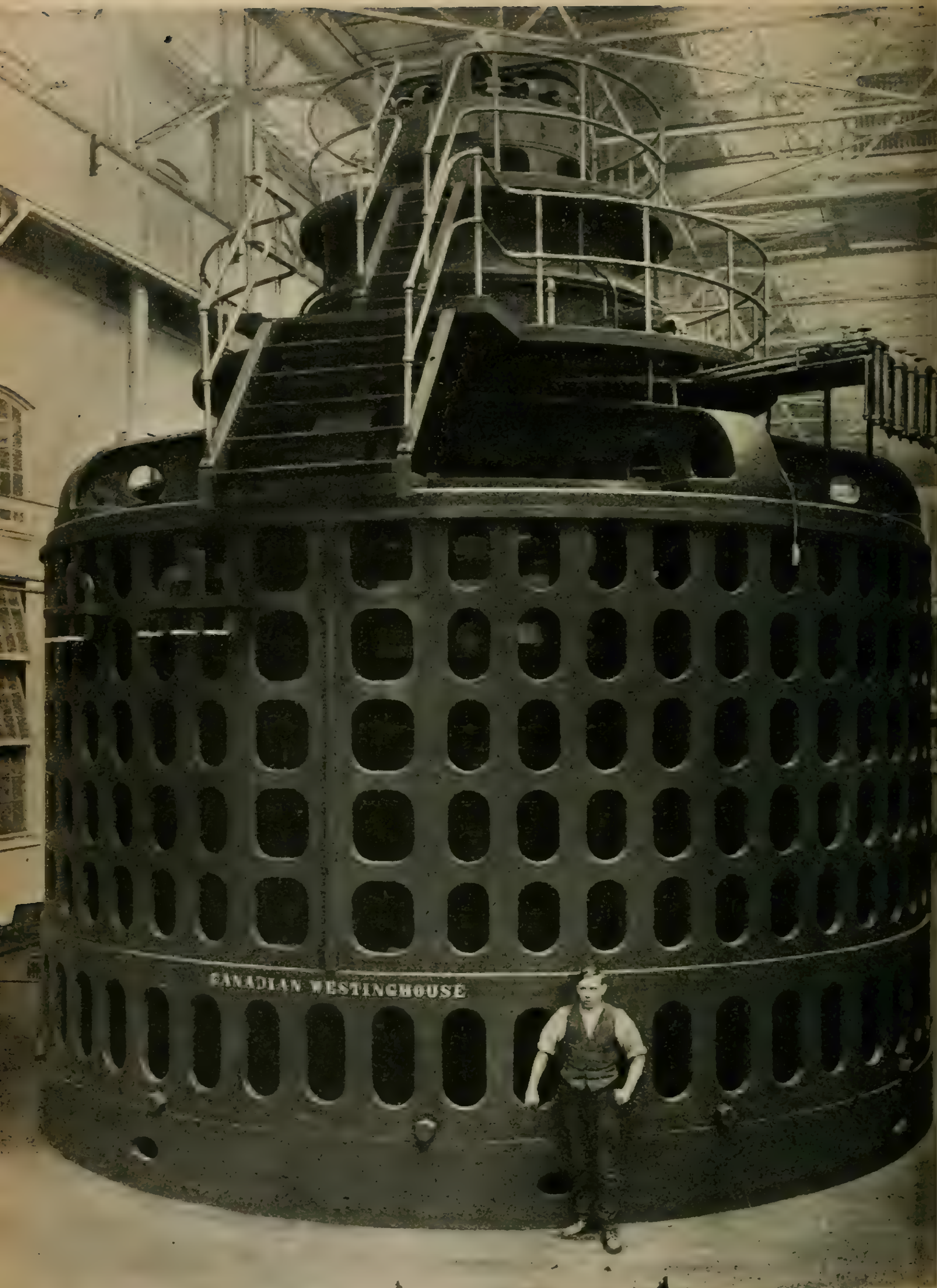


PLATE NO. 1

PLATE NO. 2

PLATE NO. 3

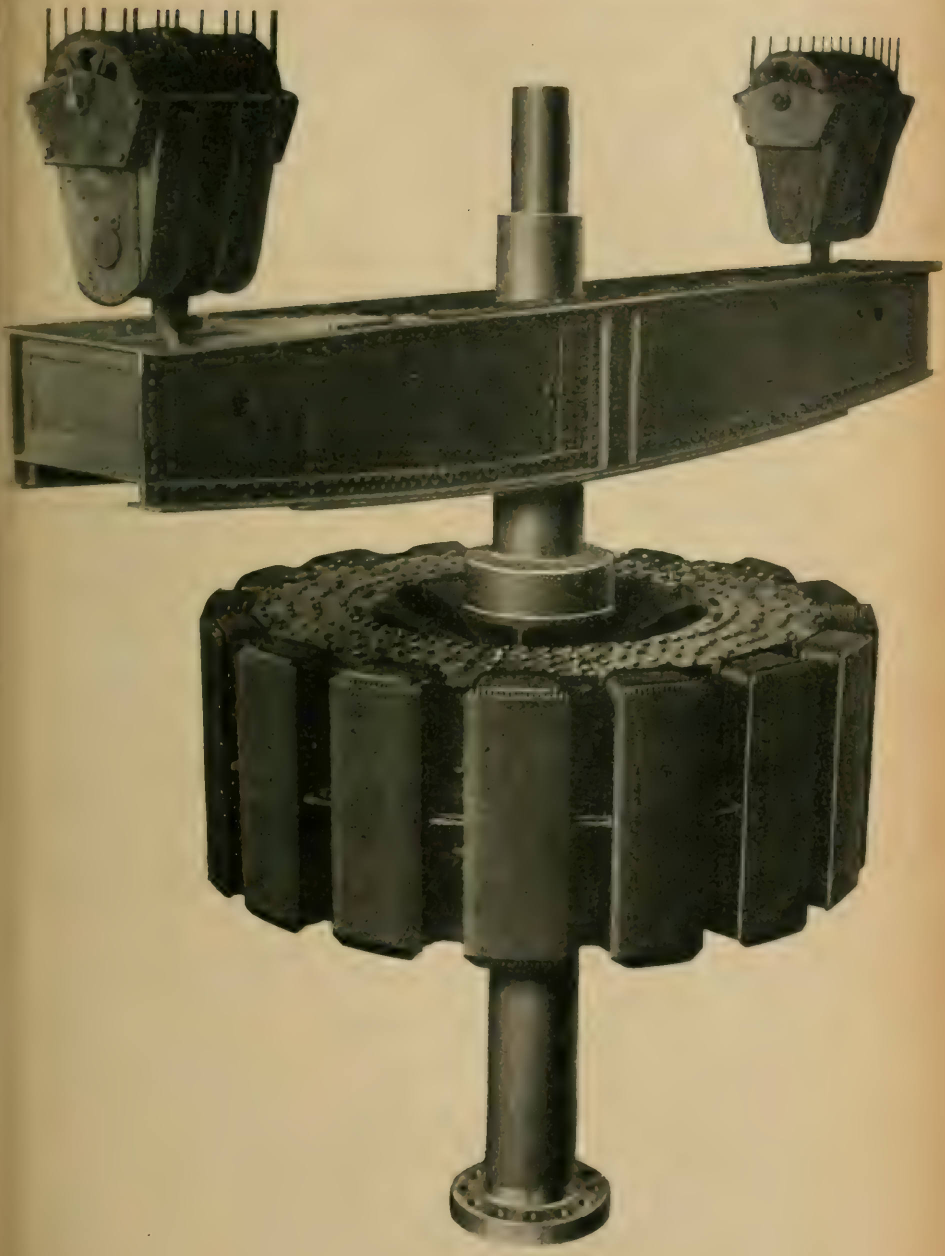


PLATE NO. 4

machine will be operated at constant temperature, whatever the load; thus avoiding sweating of the coils and wearing of the insulation due to expansion and contraction of the metal. The machine is 35 feet high from the face of the coupling to the top of the exciter. and 24½ feet in diameter.

More units of the same capacity are being supplied by the same Company, and by the Canadian General Electric Company. Some of the detail apparatus in this development includes twenty 135,000 volt oil circuit breakers, in which each pole is provided with four quick break contacts in series. The 135,000 volt disconnecting switches are swivel type.

SYNCHRONOUS CONVERTERS

Previous reports have referred to commutator flashing as a serious trouble, particularly on sixty cycle units. Improvements in commutator design and construction and the use of high reluctance commutating poles have helped the situation materially. Member Companies who are experiencing such trouble should investigate the application of "high speed" circuit breakers and flash barriers. The "high speed" breaker, as originally developed, was a cumbersome and expensive device with a consequently limited field of usefulness, but persistent designers have now brought it within reach of all and have succeeded in clipping off a couple more thousandths of a second in the time of operation. It is now safe to say that flashing can be almost entirely eliminated except in the case of very sensitive converters

TRANSMISSION VOLTAGES

The present year will see the first commercial line operating at 220,000 volts, a section of line at this potential now being under observation as a final check on the design of the engineers and several other systems being in various stages of progress. Extensive laboratory investigations show that 1,000,000 volt transmission is possible in so far as the manufacture of the apparatus and insulators is concerned, but a great deal more work must be done to show that abnormal voltage and frequency conditions can be satisfactorily controlled. It is, of course, quite evident that there is no economical justification for such a system at present and 220,000 volts is probably the highest voltage that is likely to be used for any distance up to 400 miles.

SHORT CIRCUIT CURRENTS

The development of the electrical industry during the past fifteen years has necessitated the careful study of schemes to limit the amount of power that can be delivered to a short circuit and to successfully handle such short circuits when they do occur.

Depending on the amount of impedence in the circuit, the instantaneous peak value of the short circuit current may be anything up to 35 or 40 times the rated currency capacity of the generators in the system and the sustained effective value, for a short near the generators, is usually from two to four times the rated current. In the case of a small capacity feeder connected to a large capacity system, the short circuit current may bear almost any relation to the rated capacity of the feeder. Mechanical stresses on bus supports, disconnecting switches, current transformer windings, the

series coils of feeder regulators, etc., etc., are proportional to the square of the peak value of the current. The heating effect is proportional to the square of the effective value of the current and the "short time" current carrying capacity of joints, etc., must be considered with regard to short circuit currents during the period previous to the opening of the circuit. Interrupting capacity of oil circuit breakers is now given in terms of effective current and based on a duty cycle established by the American Institute of Electrical Engineers.

Ordinarily it is sufficient to consider only the reactance of generators, current limiting reactors, transformers and lines and such a figutie will always be on the safe side. However, resistance may also show a considerable effect in limiting the short circuit current in the case of comparatively low voltage systems where the currents are very large.

In order to limit short circuit currents to some reasonable value that the apparatus can withstand successfully, modern apparatus is being designed with much higher percentages of reactance than were common ten years ago. For large generators, 15, 20, 25 and even 30% reactance is being used and for large transformers, 8, 10, 12 and 15%. Where the inherent reactance of the apparatus is not sufficient to represent economical design of a plant, external reactance in the form of current limiting reactors must be used. Such large values of reactance, of course, result in comparatively poor voltage regulation, but this can readily be taken care of by the use of generator voltage regulators.

RELAYS

Very reliable relays for protection against all kinds of abnormal conditions are now being made and excellent results can be expected if they are applied with due regard to the method of operation and the characteristics of the system. Differential relays are being used more and more, these requiring an extra set of current transformers, and also that both ends of the generator windings be brought out. That this expense is justified is indicated by the number of cases on record where such relays have confined the damage to the original fault, whereas without such relays, the fault is almost certain to spread to adjacent coils, and may even result in starting a fire.

In connection with the subject of relays, it may be well to point out that the practice of grounding the neutrals of high tension systems is extending very fast. This not only minimizes the ordinary disturbances to which transmission lines are subject, but also results in more reliable operation of the relay protective system. Grounding generator neutrals on systems which include a considerable amount of underground cable has been standard practice for many years.

AUTOMATIC STATIONS

A considerable number of small generator stations are now automatically controlled and many more equipments are on order. Automatic sub-station control has become a standard product and has been applied to motors, motor generator sets, synchronous converters, synchronous condensers and commercial feeders. At least two manufacturers are now

prepared to furnish automatic re-closing feeder equipments for out-door installation.

As an auxiliary to the automatic station and where it is desired to supervise the station continuously from a station operated by attendants, supervisory signal systems are being used. These give the attendant the same general information that he has in the ordinary electrically operated station and require only a few small wires between stations.

THERMIONIC VALVES

The manufacture of Thermionic Valves was first taken up in Canada during 1921 by the Northern Electric Company, Limited. This is the three element vacuum tube which is so necessary for up-to-date radio work. It is also the very heart of the present day telephone repeater and the multiplex telephone systems. These tubes are used as oscillators for the generation of high frequency alternating currents, they are used as modulators and demodulators for combining, and again separating voice and other frequencies. They are used as detectors, and as amplifiers, and all told they have come to be a most important part in modern communication systems.

MULTIPLEX TELEPHONY

The first system of Multiplex Telephony, otherwise known as Carrier Current Telephony, to be installed in Canada, was placed in operation last fall between Calgary and Edmonton. The system as designed for this

installation, provides for the carrying on over the same pair of wires simultaneously in both directions, three telephone conversations in addition to the single conversation which these wires could carry prior to the installation of the carrier equipment. As originally installed, only two of these additional channels were provided, but the third can be added at little expense at any time that the demand for the additional circuit justifies it.

It can readily be seen what possibilities there are for the future application of this system in our field, due to the fact that there are so many instances of thickly settled sections being divided by great stretches of unsettled territory to connect which by additional copper circuits would mean tremendous expense, and this, therefore, seems to be a rather important step in the expansion of communication systems in this country.

AUTOMATIC TELEPHONY

Interconnection between subscribers on this system is effected by means of what is known as a dial or pulsing mechanism with which each subscriber station is equipped and by means of which he sets up his own connections with any subscriber in the system, which eliminates the telephone operator except in such cases where toll charges have to be paid, and where the subscriber desires the assistance of an operator.

While there have been automatic systems in service in the Western Provinces for some years past, it has been necessary to import all of them, and it is felt that the fact that equipments of local manufacture are now available will very rapidly develop the use of the automatic telephone.

LEAD COVERED TELEPHONE CABLES

Previous to 1911 the largest commercial telephone cable consisted of 400 pairs of 22-gauge wires; in 1911 this size was increased to 600 pairs, and a few years later 900 pairs of wires were placed in one cable. The development of telephone cables has gone steadily forward, until last year it became possible to place 1,200 pairs of 24-gauge conductors in a single cable. Due to the ever-increasing population in the large centres and ever-decreasing amount of space available for cables in the city streets, this is looked upon as a very important development in this line.

INSULATED WIRE

Enamel insulated wire was manufactured in Canada during 1921 as a result of developments during the latter part of 1920. This wire is now manufactured by two companies, and is used in large quantities in the windings of various apparatus coils.

W. G. ANGUS
L. BURRAN.
J. S. CAMERON.
S. E. M. HENDERSON.
W. G. MACDONALD
J. MORSE.
G. C. READ.
W. VOLKMANN.
J. S. H. WURTELE, *Chairman*

J. H. TRIMINGHAM:—Mr. Wurtele asked me if I would present the report, due to his unavoidable absence.

In this report your attention is drawn to the increasing use of differential relays, to the automatic sub-station, and to the Thermionic Valve, which is very fast coming into use, and soon bids fair to displace the rectifying apparatus.

There is also one point which is not mentioned in this report, but which is taken up in the Electric Apparatus Report of the N.E.L.A., and that is, that they have asked for standard specification with regard to transformer taps, requiring full capacity of the transformers when they are used on the taps. In the specification got out by the Canadian Engineering Standards Association the requirements are "Taps with reduced capacity." It seems to me that there is a discrepancy here, because in step down transformers you probably want maximum capacity of the transformer when you have to use it on the taps to give high voltage on the secondary side. I think there might be discussion on that point.

Mr. Wurtele wanted me to thank the manufacturers for their help in this report, particularly the Canadian General Electric Company, the Westinghouse Company and the Northern Electric Company.

I think that is all, Mr. Chairman.

PRESIDENT:—Gentlemen, this report has been presented, and is open for discussion. We should not pass by this very important subject without some discussion on two or three matters that are touched upon here. The question of relay protection is almost a subject by itself, and is only put in in connection with this apparatus because relays have become almost a part of the equipment which they protect. I think it has been the experience of all men who have followed operating conditions in large systems that the great improvements we have been looking for for so long in protective relay systems is really at hand now. The men designing and building these relays have at last worked out the intricate problems, and are giving us relays that really do the things they are expected to do, and that don't do the things they ought not to do. So that we are getting relay systems to-day that really function as they should, and give us protection.

The first line of attack was to protect the larger units of transformers and generators, and it was of course this differential relay system that was first developed in this country, and that was originally applied to transformers. The Shawinigan Company applied this, I think, for the first time in this country, at least to the generator units, and I may say that I think now it has become the almost universal custom to protect the generators against failure by means of this differential system. It really does not protect the generator against failure, but it does against result of failure. These coils now will get the machine off the buss bar so quickly that the arc hasn't time to do damage, or the same amount of damage to the iron laminations of the machine. Without such protection not only would the coils be damaged

but the iron itself would be so badly damaged that probably every machine would have to be restacked in whole or part. In the next few years we are going to see private systems put in that are going to do the job.

In the development of these Thermionic Valves, the result is just briefly touched on. In this meeting we can hardly pass this wonderful development of radio equipment without mentioning it. While we do not wish to get tied up with anything that is nothing more than a popular fad, nevertheless the fact is there are thousands of sets being sold, and manufacturers are going into a great business developing radio apparatus. This probably will pass through the same phase that all of these things do, and as the systems improve, and the scheme gets more reliable, and when somebody can get some scheme by which broadcasting stations will get paid for their service, the whole thing will settle down and we will see a new electrical business.

The rating of machinery is pretty well established in the A.I.E.E., but our manufacturers are constantly pushing up their ratings, and to-day we find in Canada at least two ratings in standard equipment—machines rated at 45 and 55 degrees, I think. It makes a lot of difference to the operating companies. It seems hardly fair to us that the public should be using a 10 horsepower motor when another manufacturer is calling that same motor a 7½. Obviously, there is

something wrong. I do not think the public is interested whether a machine runs at 55 or 60 or 30 degrees, but they want a motor that has got on the nameplate a certain size. I believe we should discuss that matter and see whether we cannot get manufacturers to agree that they should not use these contrary and contradicting statements, at least as regards the capacities of these motors, to the general public, who are quite ignorant of the fact that the temperature has something to do with the horsepower. I should like that matter to be discussed.

E. VINET:—The question of rating which you have touched upon is coming to the fore. The Canadian Engineering Standards Association have appointed a committee to look after this matter and they are to have a meeting this afternoon. There is no doubt that the rating of motors is somewhat overlooked on account of the fact that people very often are not conversant with electric motors; they expect a motor to do more work than it is rated at. On the other hand, certain contracts are based on the rating of the motor and this should be considered. I do think this ought to be discussed here, because whatever may be said here may be of help in formulating policy to be followed by the Canadian Engineering Standards Association.

P. S. GREGORY:—I do not know whether it is in the province of this Association to say what the temperature rating of small induction motors should be, I believe, the figure should be fixed by the Canadian Engineering Standards Association, but I do think it might help their work if we went on record as favoring one standard temperature rating for the small induction motor. It is of great importance to the member-companies, because there are so many contracts drawn in which installed capacity forms the basis of demand charge. I would therefore like to move that this Association is of the opinion that one standard temperature for the rating of induction motors should be adopted throughout Canada.

PRESIDENT:—Is there any discussion on this?

P. T. DAVIES:—There are one or two ways of taking care of this matter. A motor can have two ratings. We can also protect ourselves by a clause, that in the event of the load on the motor exceeding its rated capacity, we shall have the right to charge upon the test as taken. There are two ways in which we can control the situation as regards our own operations. Personally, I am in favour of one type of motor with one rating.

A. A. DION:—I might say I am strongly in favour of it, and if this uniform rating should conform with that of the A.I.E.E., it would also be an advantage, since motors of American make are used here.

Speaking outside of the motion for the moment, I would like to take up the point raised by the gentleman who presented the report, as to the discrepancy between the requirements of transformers with taps demanded by the N.E.L.A., and those specified by the Canadian Electric Standards Association. He spoke of a discrepancy there which was undesirable. I would like to point out there is really no discrepancy, because the Canadian Standards Association's sub-Committee on trans-

formers, of which I happen to be Chairman, did not touch on step-up or step-down transformers. The specifications refer only to service transformers, to be used on poles within certain voltages. The Committee accepted this decreased capacity on taps to satisfy the manufacturers. This is not important as long as we know.

MR. BRYDER:—There are perhaps two ways of looking at this problem of temperature rise machines, especially from the point of view of charging for the installed capacity of machines. We have different classes of installations and different temperature ratings of machines in the country. Instead of trying to standardize those too much before they have settled to a permanent basis, it might be possible to standardize the method of fixing the rating for installed capacity. To show definitely what I mean, suppose figure of roughly 15 per cent. is adopted as the difference between 40 and 50 degree machine. In the absence of definite statement from the manufacturer of the particular machine, it would not be amiss for power company to make a ruling that their rate of installed capacity should be so much for a certain temperature rise machine, and if the machine is of the other temperature rise, then correction factor of 15, or whatever percentage might be agreed upon, should be adopted.

PRESIDENT:—May I ask this question? Manufacturers do not stamp the temperature rise on their machines, do they, together with the horsepower?

MR. BRYDER:—The temperature rise can always be found from serial number of the machine, by looking for it. I believe that will be true of any manufacturing company, in a large number of cases. You will find temperature rise of machine stamped on the name plate, and a place for it. Certainly it would be found whether the machine was a 40 or 50 degree machine. Temperature rise of machines is shown by these photographs. These generators are 100 degree rise machines, or 110—somewhere around there—and that type of insulation has been used, and can be used on comparatively small machines. I do not know that it has been used on induction motors, but it has been used on small generators. Machines that have been insulated with the latest kind of insulation can be made quite safe for 100 degree rise.

P. S. GREGORY:—It is not at all the intention of this motion that it will apply to generators or any apparatus that might not be considered as quantity production apparatus. I do not think any of the member companies would draw up a contract in which the installed capacity was basis of charge where amount of power purchased was, say, over 100 H.P., probably 50 H.P. would be the limit.

It is true the quality of the insulation is always improving, but there is no reason why one figure should not now be adopted, which in future years might be changed by manufacturers by agreement. I think one standard should be adopted and adhered to for the Dominion.

E. A. STANGER:—It seems to me that a very important figure of the rating of a motor is left off the name plate, and that the simplest

solution of this difficulty would be to have it included as a part and parcel of the rating.

While a motor is designed to develop its name plate capacity with a definite temperature rise, the latter important figure is practically never marked on the name plate, and as a consequence small motors are sold to-day almost on a parallel with the method used by the merchant in the Lincoln Meter Company advertisement, who measures the width of his cloth and guesses at the length.

PRESIDENT:—My own thought was along similar lines, except this, that the difficulty with any operating company, when it gets away from the cities where there is perhaps a little more expert knowledge in these things, is that the customer invariably reads the nameplate on the motor—then if there is any argument about the matter, he points to the nameplate as the last word to be said. He isn't going to take the serial number of the motor and write the manufacturer and ask what the rise is. He says: "It is a 10 H.P. motor."

We cannot object to manufacturers rating their motors at anything they please. If they can build these with better insulation, that is quite all right, but they should stamp on the nameplate that this motor is rated at 10 H.P., 40 degree rise. That is all we want. There should be an agreement that the rating of all induction motors in quantity production should be made at a certain temperature rise, and it should be made separately with all manufacturers, and then we can meet on common ground.

We ought to get something more on this, because I am sure this is an important matter for other companies, as well as ourselves, who have had similar experience.

MR. REID:—Mr. President, in regard to the commercial side, take for instance the City of Toronto. They are billing everything on demand regardless of the rating of the motors. At the present time our Company has ordered 1100 demand meters. They measure everything, regardless of the loading of the motors.

PRESIDENT:—That can be done in cities, but you cannot afford it out in the country, where a man is putting a 3 or 5 H.P. motor in the farm house, where you cannot afford to spend money on demand meters. There are lots of cases opening up where you can come to an agreement basis, but you have to have some charge by which capacity of the motor corresponds with rough measure of the demand.

Mr. Maclachlan, have you anything to say about this?

W. MACLACHLAN:—I cannot contribute anything on this subject, but I would like to point out one thing in connection with radio, which was brought up at N.E.L.A. meeting. It was pointed out that when broadcasting, the ether was very much crowded, and suggested that by the use of your distribution you can do a great deal, and possibly develop quite a business with your consumers, by using lamp socket to connect up to the distribution system, utilizing it as aerials. It was pointed out that a number of sockets have just been put on the market for this

purpose. It is something the N.E.L.A. member companies are working on, and possibly within the near future further developments along that line will be announced. Of course, the commercial side of it—receiving compensation for the service rendered, what the profit should be, will have to be worked out in the future. The use of directed wave for local broadcasting, and then arranging for receiving the longer broadcasting over the straight radio, is certainly a thing of not very far future.

MR. MCINTYRE:—Last week the Head of the Radio Corporation of America, in discussing the future development of radio, told of a new tube which has been developed and will be on the market in a few months, that will run on dry batteries. He stated his belief that the ultimate development will be an equipment energized by the commercial lighting circuits.

L. W. PRATT:—Mr. Chairman, I am entirely sympathetic with Mr. Gregory's motion, and I believe that we should endeavor to do something to standardize motors (which may perhaps prove a contentious point in dealings with our customers), but I will say that, so far as my Company is concerned, we have a very large load in which the connected load basis plays a very important part, either by way of minimum charge or basis for discount for high load factor. We have found that it is quite satisfactory to us to take the name plate rating, and I cannot recall in fifteen years' experience with the Hamilton Company that we have ever had an argument with a customer over the question of the rating. We have been content to take the name plate rating, and while perhaps in some cases we have got a little the worst of it, taking everything together we have not suffered to any extent, and, as I said before, business has been carried on without friction with our customers.

MR. ANDERSON:—I think that the manufacturer ought to be more than pleased to manufacture only one kind of motor, and it seemed to me that if he could come to an understanding on this and manufacture the one kind, he would simply have the one type of motor to make, and could make it much more cheaply than a variety.

With reference to installing metering apparatus for each motor and selling current entirely on demand, this applies already in towns and cities where you have banks of transformers, with the benefit of a lot of meters. You can allow this without any great loss, but, I believe, where we have it out in the country and customer wants a 10 H.P. motor, we install wires and line and transformers to run a 10 H.P. motor; most of the time he may be only taking 2 or 3 H.P., and in that event we are not able to bill him for his installed capacity of motor.

A. B. COOPER:—Speaking of the meters, I suggest that this problem might be dealt with in the same manner as the temperature of transformers was handled.

Referring to Mr. Gregory's suggestion, I question whether that applies to induction motors. The Canadian Engineering Standards

Association, faced with that problem, decided to handle the Bell type of transformer, and segregated them from the power or station transformers. We developed from that a standard rating, which I believe is satisfactory, and all manufacturers are supplying uniformly rated transformers for Bell type work. We still have power transformer requirements for 35, 40 and 55, with possible proficiency of 55 degrees. I think that if this motion is acted on, following recommendation of this Association for definite standardization of temperature rise, and referred to the Canadian Standards Association, that you will get quick and satisfactory results.

PRESIDENT:—This motion was put, I take it, to get an expression of opinion—the matter is to be discussed further in the Executive Session— this is only to find out the feeling of this meeting. I think it is only fair to the manufacturing companies to remind you gentlemen of the fact. Really, we cannot specify as to what the rating is. In fact, it does not matter very much what the rating is, so long as there be uniform ratings. Furthermore, it would be very bad business on our part to try to, in any way, prevent any improvements to apparatus which are going to lessen their cost to the customer, and obviously when the manufacturers can build fewer types of machines, they should be cheaper. So that our whole feeling is in favour of the motion. At the same time we meet constantly the question of the man who knows nothing about rating of machinery, and very little about electrical machinery of any kind. He cannot understand why one machine runs at one temperature, and another machine of the same horsepower runs at a different temperature, and he does not appreciate why he has been asked a presumably lower price for a hotter machine. However, I think we could avoid all that if we could, as Mr. Cooper has just said, get the Canadian Engineering Standards Association rating on the motor in addition to the manufacturer's rating. That would be the proper way of doing it. If there is no further discussion, are we ready for the question?

All in favour of Mr. Gregory's motion raise their right hand. (Carried unanimously).

We will pass on to the next report—Report of the Underground Systems Committee.

C. T. BARNES:—I think any engineer, when he starts on the design of a power house or substation, or the re-design of an old one, will find it of value to read over the reports of the Electrical Apparatus Committee, not only this year's report, but go back over the reports of the last three or four years. On reading over this year's report I came to the conclusion that something further should have been said along a certain line. I made some notes with the idea of presenting them, but fortunately I looked up the reports for two or three years past, and found the whole question had been covered more thoroughly than I had done myself. Might I make a suggestion with regard to the

work of next year's Committee—that some reference be made to the progress to be made on the electric steam boiler?

PRESIDENT:—Let us pass now, unless someone has further discussion on this, to the Report of the Underground Systems Committee:

REPORT OF THE UNDERGROUND SYSTEMS COMMITTEE 1922

VENTILATION OF TRANSFORMER MANHOLES.

Your Committee studied the question of transformer manhole ventilation as applied to the dissipation of heat generated by the transformers contained therein. If a transformer manhole is not ventilated, the heat is dissipated by conduction through the transformer manhole walls and floor, and by radiation through the manhole roof. It is obvious that at ordinary temperatures, and given a fixed wall surface, only a limited amount of heat can be carried away by conduction and radiation. The amount of heat which can be carried away by conduction and radiation varies with:

I The exposed radiating surface.

II The temperature difference and gradient between the contained air and the outside air.

III The temperature difference and gradient between the interior and exterior wall surfaces and also between the exterior wall surface and the adjacent soil.

IV The thermal properties of the material forming the walls.

V The thermal properties of the soil adjacent to the walls.

For a transformer of say 350 K. V. A., consisting of two 100 K. V. A. transformers, the three 50 K. V. A. transformers, the iron loss of one type of subway transformer is approximately 1,450 watts, and the copper loss, assuming a load factor of 60 per cent. is 2,380 watte, giving a total loss of 3,830 watts, this being equivalent to a heater of this capacity placed in the transformer manhole and allowed to operate continuously. The transformer capacity which can be operated in an ordinary manhole of approximately 12 ft. x 8 ft. x 8 ft. varies, depending on local conditions, but it is generally agreed that for a capacity above 250 K. V. A., it is necessary either to have larger manholes or use some means of ventilation. The ventilation can be either natural or forced. Forced ventilation consists of adequate openings for the incoming and outgoing air, the outlet commonly used being a pipe extending above the sidewalk level either at the curb or in adjacent openings exhausting the warm air.

Natural ventilation can be secured by providing ventilating ducts from the opposite walls to the roof; two such ducts are required, one leading from the bottom and the other from the top of the manhole. Ventilated covers are installed over each duct to give a free path to the incoming and outgoing air. As the cool air naturally falls to the bottom of the manhole, it is consequently drawn by convection across the

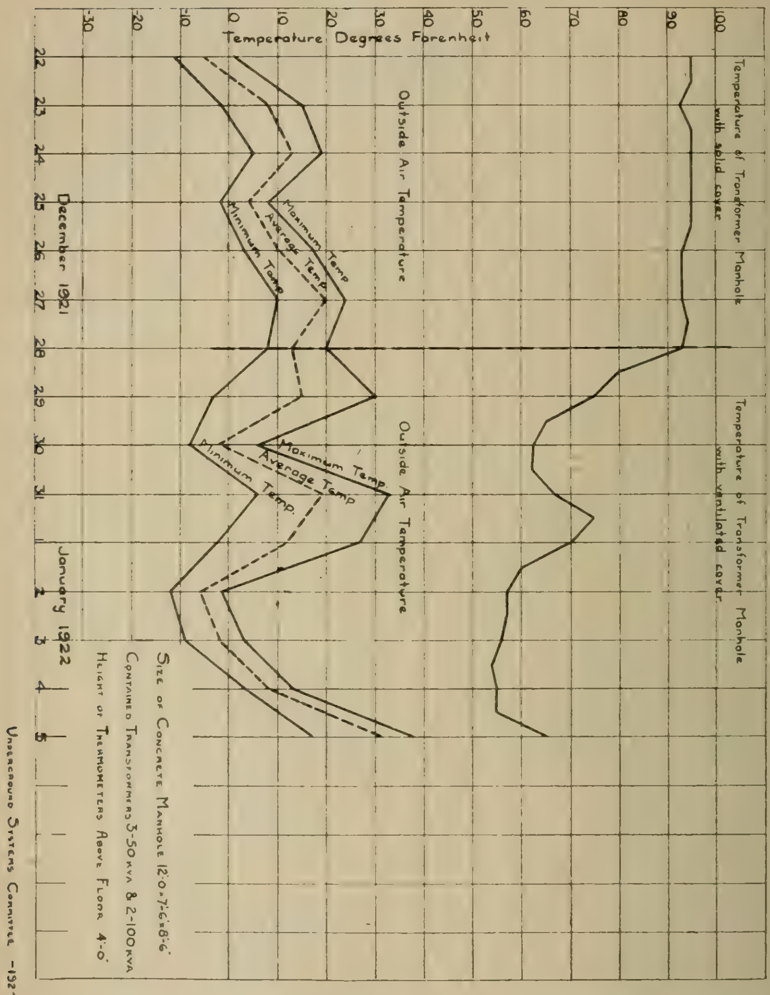


Chart showing results obtained with one manhole in Montreal by installing a ventillated cover.—(See preceding page)

transformer manhole to the outlet at the opposite end. It is contended by some that the ventilation attained by this method may become ineffective, due to interference between the warm air ascending and the exterior air currents produced by wind.

Another method of natural ventilation is obtained by replacing the solid transformer manhole covers with ventilated covers. The accompanying diagram shows the difference in temperature of a transformer manhole when equipped with solid and ventilated covers respectively. The manhole in question was 12 ft. long, 7 ft. 6 in. wide and 8 ft. 6 in. deep, the thermometer being placed at a height of four feet from the floor. The solid covers were of cast iron three-quarters of an inch in thickness. The ventilated cover was divided into three sections, each section being eighteen inches wide by thirty-six inches long, and was fabricated of one and one-quarter inch by one-quarter inch material placed on edge and spaced three-eighths of an inch apart. The total area of the cover was thirteen and a half square feet, giving an actual opening to the air of approximately fifty per cent. of the above area.

The decrease of temperature obtained by this method is, of course, limited. The temperature curve shows that the temperature of such a manhole can be materially lowered and in many cases provides a suitable means of keeping the temperature of the transformers within safe limits.

Your Committee recommends that the study of transformer manhole ventilation be continued by the incoming Committee, and that another test be made on this manhole when warm summer weather prevails, to ascertain if the same relative decrease of temperature would exist under these conditions.

PARAFFIN WAX AS A CABLE JOINT FILLER.

Your Committee took up the question of cable jointing compounds with a view of determining the suitability of paraffin wax as a filling material for cable joints. Correspondence was carried on with the leading cable manufacturers regarding the characteristics of an ideal cable compound, the following specifications was submitted, and is reproduced here:—

The compound shall have the following properties:—

I Ability to completely fill the joint and unite itself to the walls of the container, the conductors or their insulated covering, avoiding even minute air spaces.

II Sufficient pliability to allow for movement of the splice due to temperature changes or to mechanical interference and to maintain itself in contact with the conductors and container.

III Non-injurious to the container, conductor or insulating material.

IV Melting point high enough to ensure plasticity under ordinary working conditions and low enough to prevent injury to the insulating material when filling the joint.

V Non-hydroscopic and ability to resist the entry of water into a joint.

VI Dielectric strength equal or greater than that of the cable.

VII Low dielectric loss.

A filling compound can be purchased from different cable manufacturing companies, which is guaranteed by them to posses the above characteristics.

The characteristics of paraffin wax do not entirely conform to requirements of numbers I, II, IV and V. Paraffin wax, however, possesses one quality of great advantage in making joints on paper insulated cable, viz.: its great penetrating property when hot, enabling the moisture to be easily and readily expelled from the joint.

The various degrees of success experienced by jointers in using different cable compounds can, in many cases, be attributed to either the insulating quality of the material used in forming the joint, or in the method of making the joint.

In speaking of improper material particular reference is drawn to the use of cotton tape for insulating purposes, which on account of its porosity tends to lower the apparent dielectric strength of the joint as a whole. The reverse is true of paper tape when properly applied, i.e., free from wrinkles and cracks and laid on evenly and tightly.

This was pointed out by Mr. W. A. DelMar in his communication to the Underground Systems Committee, N.E.L.A., 1922.

In the Appendix to the Report of the Underground Systems Committee, N.E.L.A., 1921, page 1307, specifications will be found for making up joints on high tension cables. Anyone interested in making cable joints would be well advised to read these specifications.

Your Committee recommends that the question of joints and jointing material for paper insulated cables be studied by the incoming Committee, and, if possible, general specifications made for the making up of 13,200 volt cable joints.

DIELECTRIC LOSS ON PAPER INSULATED LEAD COVERED CABLES

With regard to dielectric loss, your Committee studied this so far as was possible in light of the report made by the Cable Research Sub-committee of the National Electric Light Association last year. The matter was discussed with representatives of the cable manufacturers in Canada, and it was evident that at the present time the manufacturers have not given this point very much consideration and are not seriously prepared to consider the matter in purchaser's specifications, nor is there at the present time facilities in Canada for the commercial checking of the characteristics of cables in this regard, though a certain amount of laboratory research work has been done.

The report of the Cable Research Committee before mentioned dwelt upon the comparative importance of the dielectric loss clause in specification showing that it is at times quite an important factor and the report actually recommends that for voltages above 7,500 volts purchasers should insist upon a dielectric loss guarantee from the manufacturer.

Your Committee, however, feels that the matter is at the present time in a somewhat embryonic stage, and that even in the United States the manufacturers are not all agreed upon this matter of dielectric loss. We recommend that the incoming committee carefully watch developments so that every advantage may be taken of progress made. However, it does not at the present time care to make definite recommendations, as it is fairly evident that this question of dielectric loss can be stressed to such an extent as to cause the neglect of other important considerations in cable characteristics and in cable manufacture.

THE BALANCED VANE ELECTROSCOPE AND NEON TUBE AS A MEANS OF DETECTING HIGH TENSION POTENTIALS ON UNDERGROUND CABLES.

During the year a balanced vane electroscope as used by the Distribution Department of one of the power companies in New York was shown the Underground Systems Committee of the N.E.L.A. A description of this apparatus by J. W. McIlvane may be found in the N.E.L.A. Bulletin, January, 1922. This electroscope is said to respond readily to voltages above 500 volts. At 12,000 V. the attraction between the live conductor and movable vane is quite vigorous when held at a distance of three inches. The electroscope can be tested by means of a polished rubber rod electrified by rubbing with a piece of silk. The use of the neon tube for indicating whether a cable is alive or not was also drawn to the attention of the N.E.L.A. Underground Systems Committee, and is used in a similar manner to the balanced vane electroscope. It is, of course, necessary to remove the metallic covering of the cables before these instruments will indicate. It is suggested that member companies try out these instruments to see whether they are of practical use in differentiating between charged and dead cables, so as to reduce to a minimum the possibility of a jointer cutting into a live cable.

METHOD OF FASTENING COVERS TO SUBWAY TRANSFORMERS

Your Committee studied this question, and has corresponded with the transformer manufacturing companies. One manufacturing company is now prepared to supply covers for subway transformers in sizes up to and including 100 K. V. A. capacity, which are fastened to the transformer case by means of one central bolt. It is to be noted that the joint between the transformer cover and case using several bolts can be made water-tight, if the bolts are properly tightened. It is, how-

ever, found that in practice the men in the field do not take the necessary time and precaution to properly set these bolts. Other things being equal, there is a greater chance of having a water-tight joint when one strong central bolt is used.

LABOR SAVING DEVICES.

It might be of interest to note that two public utility companies are using winches on their gasoline trucks operated by their cable gangs. These trucks have not as yet been in use a sufficient time to justify a report on the saving effected. This subject might be borne in mind by the incoming committee.

Respectfully submitted,

R. B. McDUNNOUGH,
H. D. JOHNSTON,
R. J. EVEREST,
W. H. MARSH,
L. A. KENYON, *Chairman.*

PRESIDENT:—Mr. McDunnough, in Mr. Kenyon's absence, is going to give us a summary of this report.

R. B. McDUNNOUGH:—The report starts off with a consideration of the methods of ventilating manholes. This question is a serious one to-day considering the large transformer capacity installed in some manholes. The copper losses amount in some cases to 3,000 or 4,000 watts, and you can imagine what the effect would be of installing a 3000 watt radiator in a room 12x8x8. Different methods of ventilation are discussed in the report and a curve is printed which shows the result obtained with one manhole in Montreal by installing a ventilated cover. This cover had approximately 50 per cent. open air space. You may see by the curve that the results were remarkable on page 122. I believe that there were some objections on the part of the City Authorities to the use of these covers, and these objections will have to be settled. Some of the United States companies are using perforated covers with good results.

Cable Joint Fillers.—Paraffin wax used to be the most extensively used filler, but there are great objections to its use. This matter was taken up with the cable manufacturers, and a specification for joint filler was obtained which seems to meet universal approval. You will note that paraffin wax does not conform to some of the requirements.

Dielectric Loss.—In the early days of cables, dielectric losses amounted in some cases to almost as much as the copper losses. Manufacturers do not seem inclined to discuss this question very much although they are gradually improving their cables, and dielectric loss has been decreased until it is practically negligible.

(Mr. McDunnough here gave an experiment with the Balanced Vane Electroscope and Neon Tube, as a means of detecting whether wire is alive or not.)

Another matter is to be taken up with the manufacturers: that is the method of fastening transformer covers. It is found that when the cover of the transformer has several bolts around it, sometimes in setting up the cover the workmen neglect to tighten all the bolts. Water in some cases has got into the transformers and ruined them. Another method is to have one bolt through the center of the cover. In connection with this, there is an air seal on the side of the cover. This method is very satisfactory, and one manufacturer is willing to install this type of cover on the larger sizes of transformers.

The report also refers to some labor-saving devices which are well worthy of attention.

Another point not referred to in this report: that is the testing of cable by high tension dirrect current. For this purpose a kenetron tube is used, and the results obtained by some companies have been well worthy of mention. Further experiments along this line are being continued.

PRESIDENT:—Gentlemen, we might have the overhead systems Report, and then we can discuss these together.

REPORT OF THE OVERHEAD SYSTEMS COMMITTEE, 1922

This Committee met at regular intervals during the past year and discussed various subjects of interest to its members, and amongst other things that were given particular consideration were heat indicating devices for transformers and the consideration of the use of lightning arresters. Various questionnaires dealing with these subjects and others were sent out and answers obtained.

The Committee have spent considerable time considering the heat indicating devices, and in this connection we cannot but mention the work done by one of its members, Mr. Stanger, who was responsible for the preparation of most of the report that deals with this important subject.

Various other items were considered by the Committee either on account of enquiries received or at the instance of Committee members. The subjects so dealt with were size and spacing of cross-arms, the use of bare and insulated wire and also the question of adopting a standard height of entry.

In connection with the question of the use of lightning arresters were the following questionnaires to Class A member companies :—

1. USE OF LIGHTNING ARRESTERS

(1) State voltage of lines in which lightning arresters are used and the type of arresters used for each voltage.

(2) State where the lightning arresters are used and the reason for such locations; also past experience.

(3) State method of grounding lightning arresters and the testing of same.

(4) Give any further details that should enlighten the Committee on the subject of lightning arresters.

The following replies were received :—

ON 2,300 VOLT LINES

9 companies use Garton-Daniels arresters.
6 " " Multi-Gap with resistance arresters.
1 " " Oxide Film arresters.
1 " " Electrolytic arresters.
2 " " Expulsion type arresters.

On 2,300 volt lines the following companies use :—

GARTON-DANIELS ARRESTERS

Public Service Corporation, Quebec.
Reid Newfoundland Co.
Northern Ontario Light & Power Co.
The North Shore Power Co.
The Hull Electric Co.
The Ottawa Electric Co.
The Continental Heat & Light Co.
The Stormont Electric Light & Power Co.
Toronto & Niagara Power Co.

MULTI-GAP ARRESTERS

Reid Newfoundland Co.
British Columbia Electric Rly. Co.
Hamilton Cataract Power, Light & Traction Co.
Q.R.L.H. & P. Co., Ltd.
Cataract Electric Co.
Cape Breton Electric Co.

OXIDE FILM ARRESTERS

Q.R.L.H. & P. Co.

ELECTROLYTIC ARRESTERS

Northern Ontario Light & Power Co., Cobalt.

EXPULSION TYPE ARRESTERS

M.L.H. & P. Co.
Hamilton Cataract Power, Light & Traction Co.

DO NOT USE OR NEED LIGHTNING ARRESTERS

New Brunswick Power Co.

ON VOLTAGES HIGHER THAN 10,000

18 companies use Electrolytic arresters.
6 " " Horngaps.
3 " " Garton-Daniels.

12 TO 15,000 VOLTS

2 companies use Multi-Gap with resistance.

ELECTROLYTIC ARRESTERS

Volts	
11,000	British Columbia Electric Railway Co.
	Northern Ontario Light & Power Co.
	Hull Electric Light Co.
12,000	Toronto Power Co.
	Hamilton Cataract Power, Light & Traction Rly. Co.
	Toronto & Niagara Power Co.
22,000	Hamilton Cataract Power, Light & Traction Rly. Co.
	Cape Breton Electric Co.
33,000	British Columbia Electric Rly. Co.
44,000	Northern Ontario Light & Power Co.
	Hamilton Cataract Power, Light & Traction Co.
	Q.R.L.H. & P. Co.
50,000	North Shore Power Co.
	The Continental Heat & Light Co.
60,000	Toronto Power Co.
66,000	M.L.H. & P. Co.
90,000	Toronto Power Co.
110,000	The Continental Heat & Light Co.

GARTON-DANIELS

12,000	Toronto Power Co. at customer's end.
	North Shore Power Co.
15,000	The Continental Heat & Light Co.

HORNGAP ARRESTERS WITH CHOKE COILS

6,600	Cataract Electric Co.
12,000	M.L.H. & P. Co.
	North Shore Power Co.
22,000	Canadian Niagara Power Co. (They connect to coke tube resistances with choke coils).
25,000	M.L.H. & P. Co.
	North Shore Power Co.

MULTI-GAP WITH RESISTANCE

22,000	Q.R.L.H. & P. Co.
	Cape Breton Electric Co.

2. STATE WHERE THE LIGHTNING ARRESTERS ARE PLACED AND REASON FOR SUCH LOCATIONS; ALSO PAST EXPERIENCE

	Gen. Station	Sub-station	End of Line	On Line near Transformer	On Line	At Ends of Cables
N.O.L. & P. Co.	X	X	..	X	..	..
M.L.H. & P. Co.	X	X	X	..	..	X
Con. Ht., L. & P. Co.	X	X	..	..	..	..
Hull Electric Co.	X	X	..	..	X	..
Can. Niagara Power Co.	..	..	..	X	..	..
Toronto Power Co.	X	X	..	..	..	..
Reid Newfoundland Co.	..	..	..	X	..	..
British Columbia Electric Co.	X	X	..	..	..	..
Cataract Electric Co.	..	..	..	X	..	At all H.T. Ends
Hamilton Cataract Co.	X	..	..	X	..	..
North Shore Power Co.	..	X	..	..	X 1 Mile Apart	X
Ottawa Electric Co.	..	..	..	X	X	X (4 per mile)
Toronto & Niagara Power Co.	..	..	..	X	..	X
Q.R.L.H. & P. Co.	X	X	X	X	..	..
Stormont Elec. Light & Power Co.	..	..	X	X	..	X
Cape Breton Electric Co.	X	X	..	..	X	..
New Brunswick Power Co.	..	None	..	..	..	..

3. METHODS OF GROUNDING LIGHTNING ARRESTERS

	Burned Plate	Driven Pipe	Ground Core	Water Pipes	Solid Ground	Coils of Wire in Soil	How Tested
N.O.L. & P. Co.	X	..	..	..	..	..	..
M.L.H. & P. Co.	X	..	X	..	..	..	..
Con. Ht., L. & P. Co.	.	X	..	X	..	..	..
Hull Electric Co.	..	..	..	X			Garton Daniels Method
Can. Niagara Power Co.	X	..	..	..	..	...	...
Toronto Power Co.	.	..	..	..	X	..	..
Reid Newfoundland Co.	..	..	..	X	..	..	..
British Columbia Elec. Co.	..	..	..	..	..	X	..
Cataract Electric Co.	.	X	..	..	..	..	..
Hamilton Cataract Co.	X	X	.	X	..	..	..
North Shore Power Co.	X	X	..	X	..	..	Magnet and Lamp Bank
Ottawa Electric Co.	..	X	..	X	..	..	Lamp Bank
Q.R.L.H. & P. Co.	X	..	..	X	..	..	..
Stormont E.L. & P. Co.	..	X	.	..	..	..	..
Toronto & Niagara Pwr. Co.	..	..	..	X	..	..	..
Total	6	6	1	8	1	1	..

New Brunswick Co. .... As they do not use lightning arresters they do not use grounds.

THERMAL TRANSFORMER LOADING INDICATORS

For various reasons Distribution Transformers are fused to-day from 100% to 200% over their capacity. On this account there is a considerable loss through burnouts which might be avoided if accurate and *continuous* knowledge of the maximum load on them can be obtained. We watch our generators and power-house transformers closely, and protect them with relays, but the distribution transformers have not received a proportionate amount of attention.

It is well known that a transformer operated near the safe maximum temperature has its life considerably shortened. With new usages of electricity, such as range and appliance loads, becoming more pronounced, this may easily occur when the method of testing the load at the supposed peak period is followed. A test made on a winter evening would not show any load on the network due to ranges, toasters, etc. There is also a certain percentage of loss due to damaged insulation, caused by surges or lightning, that I am convinced takes place over a reasonable period of time, enough to allow a damaged transformer to be located and removed for repairs before the trouble has gone far enough to require complete re-winding if an inspection could be made shortly after a thunderstorm in the vicinity.

A real need exists for a simple piece of apparatus that can be attached to each transformer permanently which will give an indication of overload or trouble in the transformer.

The practical limit of loading for Distribution Transformers is reached when the bottom spot in the transformer reaches the safe operating temperature for the class of material composing it. It is difficult in the field to actually measure this, and the next best place to get an indication of this temperature is from the oil. There are two main variables in the relationship between oil and hot spot temperatures: construction and ambient temperature. The effect of the latter is to a certain extent dependent on the former, but it is not difficult to find the allowable maximum oil temperature under the most adverse conditions for any type of transformer. From the oil temperature it is possible to obtain a constant indication of the loading of any transformer, and devices coming on the market accomplish this in two main ways, positively and negatively. That is to say, they measure the actual temperature in degrees, or indicate that a predetermined temperature has not been reached.

There are other devices which operate on the electrical input or output on a thermal basis, giving a record of the highest load over a specified time period.

The chief requirements of a permanent device to indicate transformer loading are :—

(1) Low first cost.
(2) Reliability.
(3) Positive indication.
(4) Low operation and maintenance cost.
(5) Easy calibration.
(6) Easily read and re-set.
(7) Simple and waterproof installation.

(1) LOW FIRST COST.—The amount that can be spent to fully equip a system of transformers, inspect and keep a suitable system of records, needs to be carefully worked out in each individual Company from their costs of any testing or load record system in force at present, and a careful analysis of the yearly transformer losses to separate the avoidable ones; only these should enter into this part of the calculation.

As an example.—When the Company operates an efficient Transformer Repair Shop, the cost of any load testing system in force plus 50% of the value of the avoidable burnouts would give an annual amount which could safely be spent on a thermal protective system with the expectation of saving. That is, the carrying charges, interest and depreciation on the value of the devices, plus the annual operating and maintenance charges, should be less than the afore-mentioned sum.

(2) RELIABILITY.—A high order of accuracy is not essential, an indication within 5° C—will be within the error in the assumed difference between hot spot and oil temperature; particularly if the ducts become clogged, or in zero weather.

(3) POSITIVE INDICATION.—Fully as valuable information as the knowledge that a transformer is overloaded is available when the load carried has been indicated by the temperature, as underload transformers are easily picked out, and put where they can be worked nearer capacity.

(4) LOW OPERATING-MAINTENANCE COST.—The indication of the device should be easily seen from the ground to allow of quick inspection. The device should be rugged, to stand shipment with the transformer, and movement of the cover for oil inspection, changing taps, etc.

(5) EASY CALIBRATION.—The device should be easily set to operate at any temperature when it belongs to the negative class.

(6) EASILY READ AND RESET.—This does not apply to the negative class read from the ground, but where the indication is positive it must be kept in mind that the device will probably be read and reset by a lineman wearing spurs, with only one free hand.

(7) SIMPLE AND WATERPROOF INSTALLATION.—The device should be easily installed in the field on transformers already in service.

The various devices available at present for this work are as follows :—

ELECTRICAL.—Lincoln Demand Ammeter.
C.G.E.-H 2 Ammeter.

NEGATIVE CLASS.—"Standard" Semaphore.
"Westinghouse" Semaphore.
"C.G.E." Thermotel.

POSITIVE.—Clinical or Stricture Thermometer.
Packard Transformer Temperature Signal Thermometer.

G.E.-H2-LINCOLN DEMAND AMMETERS

These operate on the heat storage principle, based on the current flowing in the circuit measured, and allow for the time element as affecting the heating of a transformer.

The current is made use of to heat a bi-metallic strip which bends and moves a pointer through a mechanic which leaves it at the highest indication reached. They are graduated in amperes, and register approximately 85% of a steady demand in ⅓ of the time period of the machine.

STANDARD AND WESTINGHOUSE SEMAPHORES

When a definite predetermined temperature has been reached in the transformer these semaphores display a signal easily visible from the ground.

"STANDARD" SEMAPHORE

The actuating principle of this device is a coil of bi-metallic strip, which causes rotation of a shaft in proportion to the temperature to which it is subjected. On the top of the shaft is an adjustable disc with a notch cut in it. This supports a shutter by means of a pin which drops through the notch when the predetermined temperature is reached, thereby exposing the danger signal which can be seen from the ground. The shutter is re-set by means of a pin projecting through the bottom of the case.

The temperature at which the device operates should be decided upon, and the machine adjusted and tested before it leaves the shop. The latest model of this device gives a warning signal in addition to the danger one, in that the target drops half way at a temperature about 9 degrees below the final setting for the danger signal. It is installed in the cover of the transformer in a suitably threaded hole.

WESTINGHOUSE SEMAPHORE

Bi-metallic strip is also the principle of this device, the form of strip being straight, instead of coiled. The target is held normally inside the casing of the device by means of a hook bearing on the edge of the strip. When the strip bends under the influence of heat it releases the target, allowing it to drop and become visible. Temperature adjustments are made by means of a cam and spring exerting a variable pressure which the strip has to overcome to release the shutter. It is installed in the side of the transformer casing, and the device is made in two parts that are easily separable: the socket into which the signal proper screws being made of brass, and intended to be screwed permanently into the case. On account of its location below the oil level, it is necessary to empty the case to install the socket, and it would be difficult to do this in transformers already in operation. Also care must be taken in making the installation to get an oil-tight joint.

G.E. "THERMOTEL"

This is similar to the Standard Westinghouse Semaphores, with an additional ambient temperature compensating device which allows the signal to be tripped at a lower oil temperature as the outside air temperature decreases. Bi-metallic strip is used in this also, but there are two separate units, one in the oil, and the other in the outside air. They are

arranged so that the tripping point of the signal is varied with the outside temperature. It is easily installed, being hooked over the edge of the transformer so that the strip is immersed in oil. It is necessary to cut away a piece of the gasket to allow the cover to be clamped down tight. It is not suited in its present form to all transformers, being specially designed for the H K Transformer.

THERMOMETER—STRICTURE TYPE

In this method a thermometer of the clinical or stricture type that remains at the maximum temperature reached is used. It is graduated from 0° to 100° centigrade, and is protected with a light metallic armour to guard it from accidental knocks while reading and re-setting. This is suspended inside a pipe capped at the bottom and extending up through the cover for one inch, and down below the normal oil surface for three inches. The pipe must be installed in the cover in such a location that it gives ample clearance from the coils and primary and secondary leads. The lower end should be about three inches below the normal level of the oil, and the top should project through the cover from $\frac{3}{4}''$ to $1''$, to allow the cap to be screwed on.

While the thermometer does not give a signal visible from the ground, it offers an advantage that the purely signal devices do not give, namely, an index of the load conditions of each transformer which will prove valuable in that all transformers may be worked to full capacity by cutting over load or exchanging an underloaded transformer with a smaller overloaded one

The thermometers should be read once a month, and a record of temperatures kept in some form of card index; preferably plotted in graphic form for each transformer. The slope of the curve so formed will give an idea of the time any transformer will have to be replaced by a larger one, and the records of a system will allow a fairly accurate forecast of transformer requirements for any future period. I would suggest that they also be read a day or so after an electrical storm in the vicinity, so that transformers running hot on account of damaged end turns caused by lightning may be detected and removed for repairs before they burn out.

Another point of advantage, though a minor one, is that the thermometer acts as an oil gauge

PACKARD TRANSFORMER SIGNAL THERMOMETER

This machine combines a signal visible from the ground, and a record of the actual maximum temperature reached which can be read from a close inspection. It is easily reset to the temperature at time of resetting by a touch on a releasing pin, which disengages the ratchet holding the drum at the maximum reached

Bi-metallic strip is used in this also, its action being to rotate a drum visible through a glass window in the cover. The drum is graduated in degrees, and painted black and white, the junction being diagonal so that as the drum rotates the white appears in the upper left hand corner and

gradually fills the window, so that a white signal is seen from the ground when the transformer is overloaded. The drum indicates the maximum oil temperature reached, and is held by a ratchet until reset by pressure on a small pin.

It is installed in the cover of the transformer in a $\frac{3}{4}''$ hole tapped to take the threads on the signal.

Thermal transformer protection can be installed and operated for prices ranging from $2.00 to $8.00 per transformer per annum. In a large percentage of cases it will pay to install complete protection of this type.

The question of installing at least a small trial set in one section is worth serious consideration by any Company. If installed in a section containing a good range load, they soon pay for themselves, and will give very valuable information on this subject if of the Positive type. Recent tests with recording instruments have shown some remarkable results as regards ability to carry a large connected load, 50 per cent. ranges, on a transformer.

Routine inspection, and reading when of the positive type, is advisable, and where the device used is of the negative type, a warning signal should call for the installation of some recording type of instrument to investigate the load conditions before action is taken to change the transformer, unless it is evident that trouble in the transformer or on the network is responsible for the signal.

This is where a signal visible from the ground is valuable, as it enables an inspection to be made from a car quickly, and enables concentration of investigation on the danger spots. Where in addition positive indication of loading can be obtained three or four times a year, intelligent planning of the best use of the transformer capacity can be carried out.

Investigation should be made on the various types of transformers in use at present to determine the relationship between the oil temperature and the hottest part of the windings under various ambient temperature from 10° C to 40° C under full load conditions. In the *Electrical World* of April 1, 1922, there is an article by Mr. L. L. Elden, of the Edison Electric Illumination Company of Boston, giving the results of laboratory and field tests on old and new types of transformers. To quote Mr. Elden : "In developing a standard to be employed generally in operating transformers on a temperature basis, it was found desirable to measure the actual temperature developed within units as usually installed and operated. An exhaustive study of oil and coil temperatures in all types and sizes of transformers was undertaken in the field, from which much valuable data were obtained on the effects of ambient temperatures and loading upon oil and coil temperatures. These studies included the effect of seasonal variations in temperature upon the internal temperatures of transformers as developed under various loading conditions.

"It developed that if the temperature rise of the windings was to be gauged by the rise in oil temperature, there was only a limited area of the oil body within which the oil temperature consistently followed the changes in coil temperature due to load changes or other causes. Tests clearly

showed that the oil temperature at that point did not vary consistently with coil temperatures, and these also varied widely with different sizes and types of transformers. At this location the temperatures were also measurably affected by the use of oils of different densities as well as by the different quantities used by the several manufacturers in their respective designs.

"Temperatures at D, ½ in. (12.7 mm.) above the coils, at E, 2 in. (50.8 mm.) above, and at F, approximately 4 in. (101 mm.) above the coils were found to vary not over 3.6 deg. Fahr. (2 deg. C.) from each other and consistently to follow those observed at G and C at all times regardless of changes in ambient temperature or loading conditions within reasonable limits.

"As a result of these tests it was determined that the only reliable location in which to measure oil temperatures as a basis for determining transformer loading conditions was in a position directly over the coils and in close proximity thereto."

To sum up :—There is considerable available capacity in any existing transformer system that may be utilized. Advantage may be taken of the increase in capacity during cold weather, which in this country coincides with maximum demand to a large extent. Certain classes of trouble may be detected and the transformer removed for repairs before the damage has progressed to such a point that complete re-winding is necessary, if a system of this type is installed. Further, considerable saving may be effected, and better service given. One Company expects to save annually 3% of the amount of their transformer investment by the installation of a thermal protective system.

The Committee wishes to thank the members who generously replied to Questionnaire.

The Report of the N.E.L.A. Overhead Systems Committee for 1921 contents of Volume 2, page 649 to 869, occupying some 220 pages, gives some idea of the different subjects which this Committee takes up and deals with in our regular every-day problems, and thus valuable information can be procured by the C.E.A. members from this Report.

Respectfully submitted,

R. B. McDUNNOUGH.
G. M. ANDERSON.
O. V. ANDERSON.
A. A. DION.
E. A. STANGER.
A. P. DODDRIDGE, *Chairman.*

CHAIRMAN:—Mr. Doddridge, will you give us your Summary?

A. P. DODDRIDGE:—Previous to drawing up the report, we took up a few subjects which we thought would be of interest, and found in going through the previous reports of the Overhead Systems Committees that they had been pretty well dealt with.

The principal thing which your Committee decided on was to send out questionaire covering: 1. Use and type of insulators used. 2. Location of lightning arresters, and reason for such location. 3. Past experience on the method of grounding arresters and testing same. 4. Further comments that might be made. In the report you will see summary of practices from the returns of the different companies.

What we consider the most essential part, and something which is bound to be of great value to the Association, is the Thermal Transformer Loading Indicators. That is a subject we have dealt with, and it has been extensively taken up by the N.E.L.A.

We had on our Committee Mr. Stanger, of the Southern Canada Power Company. A peculiar coincidence might be mentioned. After Mr. Stanger's report was written, and report of the N.E.L.A. received — while the N.E.L.A's was more elaborate, the essential features of Mr. Stanger's report coincided with that of the N.E.L.A.

Question of overloading is quite a factor, and results show that the companies installing indicating devices have been more than repaid for their trouble. Evidently this has been a serious question with the transformer manufacturers, as several of them have got special devices out, and are improving them constantly. Since this report was made, the Packard people especially have produced an apparatus which we thought was very applicable to the different transformers, it eliminates the necessity of a man climbing the pole to get the reading.

PRESIDENT:—Are there any questions on these two important reports, the Underground Systems Report, in which two or three matters were raised dealing with the temperature of cables and manholes, and the Overhead Systems Report, in which Mr. Doddridge spoke of lightning arresters and Thermal transformers loading indicators? Any discussion on these points?

R. J. EVEREST:—I would like to open discussion as to the actual value of lightning arresters on a 2200 V distribution system.

From my own observation it would appear that such lightning arresters are installed by most Distribution Companies without any attempt to actually protect individual apparatus. It would appear that the usual practice is to distribute these arresters, as evenly as possible, over the system, and I am very much of the opinion that arresters installed, in this way, have very little protective value and that they are rather a source of danger and a menace to continuous operation.

The lightning arresters, chiefly used for this service to-day, are of the Garton-Daniels or multiple gap and resistance type, and these are from my experience very likely to break down during a disturbance, and when there are several on one feeder, this feeder is out of service until the defective arrester can be located. The locating of a defective arrester is sometimes difficult, particularly at night, as it is necessary to inspect each one on the feeder. In addition to this I consider that the arc which takes place when an arrester breaks down causes local

oscillations which tend to produce potentials high enough to destroy connected apparatus. I know, from actual experience, that an arc to ground, on a distribution system, will break down such apparatus and I consider that if lightning arresters are to be of any value at all, they should be installed to protect individual apparatus, and should be a type which does not rely upon the actual spark discharge, but rather of some type which will allow a discharge in one direction only, an arrester which is, of course not at present available for this purpose.

Three Wire Vertical Distribution.—Due to the increasing use of three wire vertical distribution in this country, I would like to hear discussion as to the advisability of arranging to have the neutral wire placed on the top, instead of in the middle as at present. My reason for suggesting this charge is that, should a High Tension wire carried on the same pole line break, it will fall across the neutral wire, which is, of course, grounded and this will obviate the possibility of the high voltage damaging apparatus. It is, of course, understood that with the neutral wire properly grounded this is not likely to occur, but I consider it very advisable that as direct a path as possible to ground be provided. In connection with this, I have heard to-day that an article appeared in a publication on this very subject this week.

Temperature Indicators.—In conncetion with a device to indicate a safe working temperature of service transformers.

About two years ago I commenced investigating the possibilities of operating transformers entirely by temperature rise, irrespective of their K. W. capacity and for this purpose equipped transformers with maximum indicating thermometers and found this method to be entirely satisfactory.

The method of keeping record of temperatures is to have a periodical inspection and to record temperatures readings on a transformer card. In addition to this connection department take the temperature reading of any transformer to which they connect a load exceeding 3 K. W. This reading being entered on the service order, in this way it is possible to keep a very close check on load conditions. I consider that the temperature of the oil is a safe guide and that transformers can be operated with more safety by keeping a record of temperatures than by observing the loads carried. We have transformers installed in lanes between high buildings and find that they cannot carry the load that the same transformers would carry if installed in an open street or lot.

Since we started operating by temperature, we have not only greatly reduced the number of burnt out transformers but have reduced the number of transformers in service on the System. In addition we have not lost any due to lightning, this being due to the fact that transformers are not operated at a high enough temperature to damage insulation.

The Chairman referred to the growth of radio.

In every town to-day, aerials are going up in all directions. In our district there is a tendency to sometimes place them in dangerous places, and to put them up in such a flimsy manner that they tumble off the roofs and fall across our lines. The local authorities encourage radio and let people string their wire across the streets. This is not only dangerous to life but is a menace to operation. We have found that the best way to handle this is to take the matter up with the Chief-of-Police and point out the danger and ask that before permission to cross streets is officially granted, the matter be referred to the Power Company. I consider that this is quite a serious problem in many towns.

K. A. McINTYRE:—On the point of aerials and their interference with central station lines, in Dayton, Ohio, the central station actually installs aerials. They have a cheap setup of their own, they do it at cost, and take the responsibility.

W. MACLACHLAN:—In some cities newspaper information, containing some good data, has been gotten out. This has been prepared by the electrical interests and handed over to the newspapers, who gave it good publicity. This was prompted by the number of accidents occuring. Aerial mounted inside the house are almost as efficient as the aerial outside, and are guaranteed in all cases so long as there isn't a metal roof on the house.

W. H. WINTER:—I would mention that next year the Overhead Systems Committee might consider in their findings something in regard to joint occupancy, or the joint use of poles, by lighting and signal companies. I think it is a very important matter because the need of reducing cost is urgent, and undoubtedly we have got to meet the wishes of a great many of the municipalities to try and reduce the number of pole lines in the streets. I think that is one point that the Overhead Systems Committee should consider in their next year's work.

PRESIDENT:—Mr. Winter's point seems very well taken. I think we can tell the Committee to do that.

MR. SMART:—I am in agreement with Mr. Winter's suggestion for the joint use of poles. I think another suggestion may be made here at the same time, that arrangements should be made with the telephone companies to try and get them to stick to their own side of the road as much as possible. I don't say they are always at fault, but I think some arrangement could be made whereby this should be taken up and have each company stick to their own side of the road as much as possible.

PRESIDENT:—Mr. Smart has made an interesting suggestion that perhaps the telephone companies might not always agree to, I think in connection with Mr. Winter's suggestion, the whole problem could be gone into, and there might be in districts where there are many trees or obstacles some sort of joint occupancy worked out for shorter distances that would meet Mr. Smart's objection. Of course you are all interested more or less now in rural distribution, but the fault goes away back to the days when the roads were surveyed and mapped out,

though most of the roads were not surveyed, they just grew there, and dodged every little change of level, and went back and forth so that the roads as a rule are never straight, or of the uniform width. In stringing lines along these roads, the tendency is to jump back and forth from one side of the road to the other. This sort of thing makes things difficult, and in many ways a rather dangerous type of construction, particularly if the road becomes crowded, and has other lines erected on it.

There is one point that I should like to see discussed a little bit. I think we are entering upon a period of changing our standardized apparatus. It seems to me that the 110-2 wire and the 2200-2 wire distribution systems are beginning to weaken, and that we are going into the 3 wire systems now, of which we see already quite a bit of low tension 3 wire system. We are probably going to see quite a lot of 4,000 volt 4 wire systems put up, and that again is going to cause more trouble, interference and difficulties with our neighbors in the systems of communication.

I should like to hear from some people who have had experience with these systems, which is very interesting, particularly as applying to rural districts. Is there anybody here using the 440 volt 4 wire system?

MR. WILSON:—We have 40 miles of 440 volt 4 wire system through rural district, and we would not think of making any change, as it has worked out so satisfactorily. The initial cost was low, and we would not consider anything else. We have nearly 3,000 customers throughout the country, and it is working out very successfully.

E. A. STANGER:—We have been using that system for some time past, rurally and in towns, that is, three wire vertical distribution with the grounded neutral as the top wire. Shortly we except to change a system of that type from 2,200 volt, three phase to 4,000 volt, three phase, 4 wire primary, my making use of the same grounded secondary neutral as a common neutral for both primary and secondary. The use of this vertical system considerably facilitates this change. It seems to me that it is the logical system to use in new construction to allow for future growth in thinly populated districts with a minimum of work later.

W. H. WINTER:—I would like just to say that where such a condition exists and electric light and distribution companies are about to operate, we are always open to meet them in a broad spirit of trying to straighten out any matters of this kind. Of course, always with due regard to our vested rights.

PRESIDENT:—I think the power companies have always found the Bell Telephone Co. anxious to meet them in the difficulties which arise, and which are due very largely to the growth of this rural distribution work.

The power companies, so far as I can see, are not so terribly anxious to go on with it, but we are forced to go on into it, into types of construction and schemes that will enable us to deliver the loads over

long distances at comparatively small investments. The answers has yet to be found that is entirely satisfactory, and I do not know whether it is possible to solve the problem properly.

At any rate it is going to mean, I believe, personally, higher voltages, up to 4,000 or 6,000 volts, and joint occupancy of poles, and other schemes that mean the saving of money in serving these customers scattered over wide areas.

This matter, as I see it, could easily be settled by some of our committees, and we are waiting with interest to get an economical result. This scheme works out in broad lines something like this: For one wire or one phase it is pretty good, because in that case you compare two conductors or one conductor, if you want to put it that way, with the cost of the pole line. The underground system and pole line work out about equal, but when you come to three conductors to deliver three phase power, as against one pole line carrying three conductors, then underground apparently is completely but out of business, because poles cost no more to carry three conductors than they do to carry one. There are undoubtedly many locations where, on account of trees, buildings, or other considerations, the underground system is going to come in, and it is possible that it has a very considerable future. We are watching to see whether it can be used in a big way. Where you have a selected community with 25 or 50 KW load, you may be able to put single phase down as cheaply as a pole line, but if you are going to try to run a motor on that, you have to build a pole line. The question of growth is involved, and it is somewhat doubtful if this really is the answer.

MR. SHORT:—I have heard of instances where the farmer pays a proportion of the expense of installation, he provides the labour, and an expert electrician does the wiring. I do not know much about it myself, but I heard of a great many cases, when after a farmer had the cable laid down and it was connected up, that it proved to be dangerous, it meant keeping the cows away from it.

With regard to the use of determining capacity of transformers, it seems to me the possibilities of using graphic recording thermometers is the inevitable solution on maximum indicating thermometers.

A. A. DION:—A system which has a important bearing on the rural lines, economically, has been developed by the Hydro Electric System in Ontario. Half the cost of rural lines is borne by the Province out of its funds, so that the Hydro only has to carry half the initial cost. Then the farmers are canvassed, and they have to agree to pay minimum charges, which depends on the number of customers secured per mile of line. This forms the basis of contract which farmer signs, an then the contract is registered in a registry office and becomes a lien on his property for 20 years. You will see how much the problem is simplified.

MR. MUDGE:—A short description might be interesting of the changeover of a 2,200 volt, three phase, 3 wire system, to 4,000 volt, 4 wire system in an Ontario town. It is a town of about 3,000 inhabitants.

The power was supplied from water power station, and the load was fully two miles away from the station. They had been supplying power for some years at 2,300 volts, 3 wire 3 phase, total load being about seven or eight hundred KW. The drop was very heavy, about 20 per cent.—so that the lighting service was far from satisfactory. Question came up as to what to do, and it was finally decided to put in a large amount of additional copper. Transformers were put in at the power house, stepping up from 2,200 to 4,000, and then one additional wire was put up to the town, otherwise the old circuit was used. Distribution transformers in the town were changed over. Of course the same transformers were used, and that change was made over the week end. It has worked out very satisfactorily, and has given very much better regulation and at very much less cost than they could have done the work in any other way.

PRESIDENT:—Did the same transformers work all right with one side grounded?

MR. MUDGE:—I have not heard of any trouble having occurred due to changeover.

E. A. STANGER:—Did you have any experience in operating open delta banks on 4 wire 3 phase.

MR. MUDGE:—It was used and has worked out satisfactorily.

PRESIDENT:—We will have to hurry this meeting on account of our luncheon, and have got about fifteen minutes left. Mr. Kintner, can you give your Lamp Report in that time?

REPORT OF LAMP COMMITTEE

INTRODUCTION

In this report the Lamp Committee has confined itself largely to presenting information that will be of an educational and technical value to the member companies and to the lamp consuming public in general. In the future it may be advisable that the committee collect more detailed information in regard to lamp sales and to the distribution of the various types and voltages.

AN ANALYSIS OF LAMP CONSUMPTION

Of the many million of lamps consumed annually, the following analysis indicates the relative proportion of the various wattages and types.

The 40 watt vacuum is apparently the most popular size, with the 25 and 60 watt sizes following closely

TYPE "B"

Sign Lamps	3.1%
15 Watts	4.6%
25 "	20.8%
40 "	22.5%
50 "	10.2%
60 "	17.2%
100 "	1.6%
Street Railway	1.9%
Others	2.1%
Total	84.0%

TYPE "C"

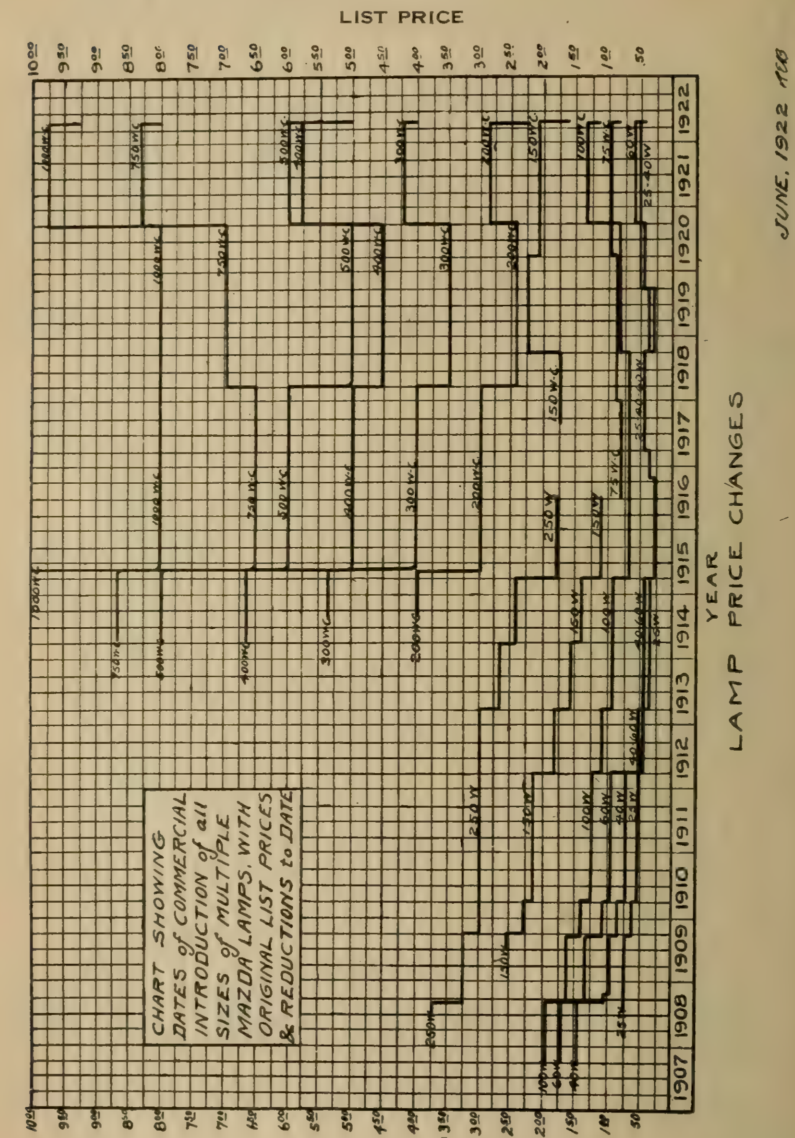
50 Watts	2.9%
75 "	4.0%
100–150 "	5.7%
200–250 "	2.1%
300–1000 "	.7%
Street Series	.2%
Others	.4%
Total	16.0%

LAMP PRICE CHANGES

The accompanying chart shows the dates of introduction of the various types of lamps, also the history of price changes between the years 1907 to June, 1922.

After the introduction of the drawn-wire tungsten lamp, a reduction in price took place and prices have since gradually decreased, except for a period as a result of the war.

It is satisfying to note that with the falling prices there have been also increases of efficiency.


LIST PRICE
CHART SHOWING DATES of COMMERCIAL INTRODUCTION of all SIZES of MULTIPLE MAZDA LAMPS, WITH ORIGINAL LIST PRICES & REDUCTIONS to DATE
YEAR
LAMP PRICE CHANGES
JUNE, 1922

LAMP IMPORTATIONS INTO CANADA FOR CONSUMPTION

Below is given a table as supplied by the External Trade Branch of the Dominion Bureau of Statistics. On this we have noted that 70% of the lamps imported into Canada for nine months ending December 31, 1921, were imported from non-English speaking countries. The largest number of lamps imported from any one country was the Netherlands, with the United States coming second, for nine months ending December 31, 1921. Also the importations from Japan apparently are on the decline.

IMPORTS OF ELECTRIC LAMPS INTO CANADA FOR CONSUMPTION

		Years Ended March 31		Nine Months Ended Dec. 31	
		1920	1921	1920	1921
Lamps, electric, arc—					
From United Kingdom	$	....	73	....	....
From United States	$	9,719	28,669	20,403	17,301
Total	$	9,719	28,742	20,403	17,301
Lamps, Electric, Incandescent					
From United Kingdom	No.	....	52,045	18,111	112,216
	$	1,479	8,592	6,249	19,355
From United States	No.	....	3,372,608	2,972,228	551,049
	$	1,153,407	970,163	867,707	121,275
Austria	No.	....	6,153	864	7,379
	$	....	1,027	195	882
Belgium	No.	....	6,550	....	138,830
	$	....	3,775	....	60,321
Czecho-Slovakia	No.	....	....	....	18,022
	$	....	....	....	1,733
France	No.	....	203	303	5,871
	$	504	277	277	1,014
Germany	No.	....	....	....	50
	$	....	....	....	119
Hong Kong	No.	....	10	10	204
	$	....	4	4	75
Japan	No.	....	777,207	735,057	386,676
	$	11,316	58,770	54,793	27,909
Netherlands	No.	....	832,590	527,619	1,039,552
	$	128,591	141,536	88,577	192,875
Switzerland	No.	....	....	....	6,707
	$	....	....	....	1,607
Total	No.	....	5,047,469	4,254,192	2,266,556
	$	1,325,297	1,184,504	1,017,802	427,165

INSPECTION OF LAMPS

The inspection of lamps at the point of manufacture is a proposition well worth consideration by the large consumers of incandescent lamps such as, Dominion and Provincial Governments, Municipalities, Hydro-Electric Commissions, Public Utilities, and large industrial concerns. A very good indication of the probable life and performance of a group of lamps may be obtained by a mechanical inspection of the lamps along with Photometry readings. The most convenient place for an inspection of this kind is at the place of manufacture, where proper facilities are available for the inspection and photometering of the lamps.

The following points should be considered when inspecting the quality of a group of lamps :—

1. Workmanship.
2. Uniformity of filament mounting.
3. Soldering and lead wires.
4. Strength of basing cement.
5. Lamp rating of Representative selection.
   (*a*) Average watts per candle or lumens per watt.
   (*b*) Maximum or minimum variation from designed watts per candle or lumens per watt.
6. Light center and overall length.

THE EFFECT OF VOLTAGE FLUCTUATION ON LAMP LIFE

The effect of voltage variation on tungsten lamps is very marked. A person unfamiliar with lamps might assume that if a lamp designed for certain voltage should burn a certain number of hours at over voltage, and the same number of hours at a corresponding under voltage, that one would compensate for the other, but such is not the case.

The relation between life and voltage is expressed in the following formula :—

$$\frac{l}{L} = \left(\frac{v}{V}\right)^{d}$$

l—Life of lamp at any voltage, v.

L—Life of lamp at rated voltage, V.

d—is an exponent which for tungsten lamps is 13.8

As an example, if a 110-volt tungsten lamp is burned for 25 hours at 117 volts, and for 25 hours at 103 volts, there is a loss in the designed life of the lamp of 27.8%. The above shows very well the effect on lamp life of voltage variation.

At 117 volts the life would be but 42.2%, thus $\left(\frac{1\ 110}{L\ 117} = \left(\frac{117}{110}\right)^{13.8}\right.$ of the life at 110 volts. Thus, the 25 hours of burning on 117 volts would be equivalent to $\frac{25}{.422}$ or 59.2 hours of burning at 110 volts. The per-

centage life for 103 volts is 251%, thus $\left(\frac{1}{L}\ \frac{110}{103} = \left(\frac{103}{110}\right)^{13.8}\right)$ The 25 hours at 103 volts is equivalent to 10 hours, thus $\left(\frac{25}{2.51} = 10\right)$ at 110 volts. During the two periods of 25 hours the resultant consumption of life of the lamp has been 59.2 plus 10.0 or 69 hours, a loss of 19 out of 69.2 or 27.8% in the life of the lamp.

Curve No. 2 given below shows the relation of lamp life and voltage.

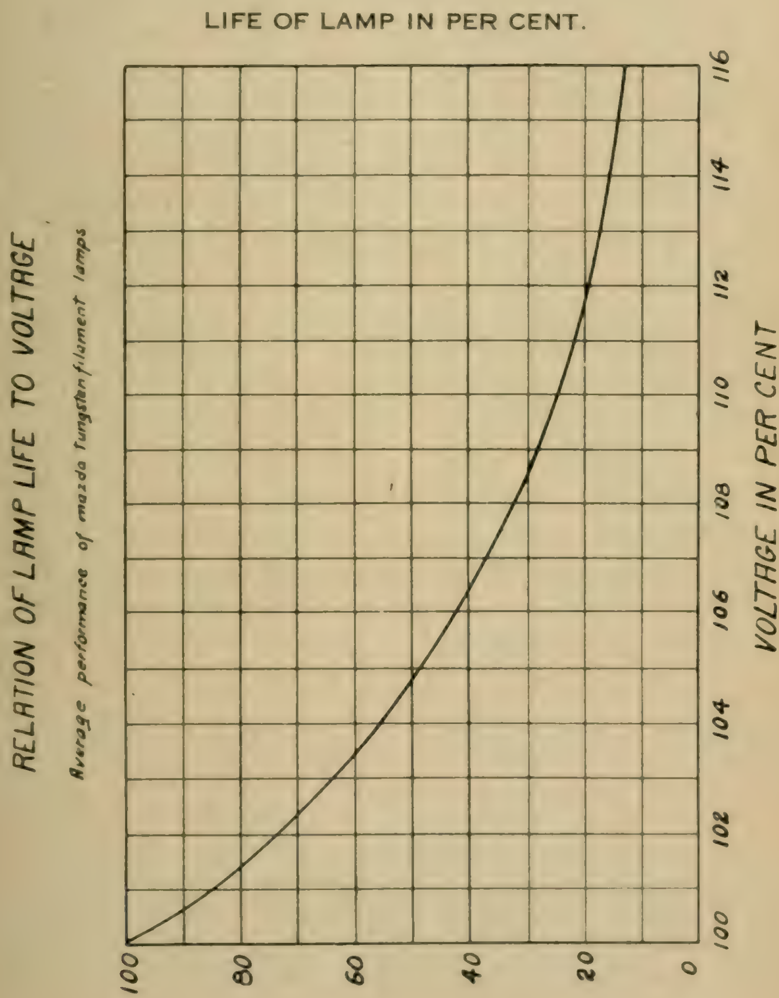


FIG. 1

This refers to a condition where lamps are burned continuously at over voltage. As an example, if lamps are burned at 106% volts, the lamps will only give about 42% of the designed life.

Curve No. 3 gives the relation of Candle Power to voltage on Tungsten Filament Lamps. The curve shows that with a comparatively small reduction in voltage that there is a large decrease in the light output.

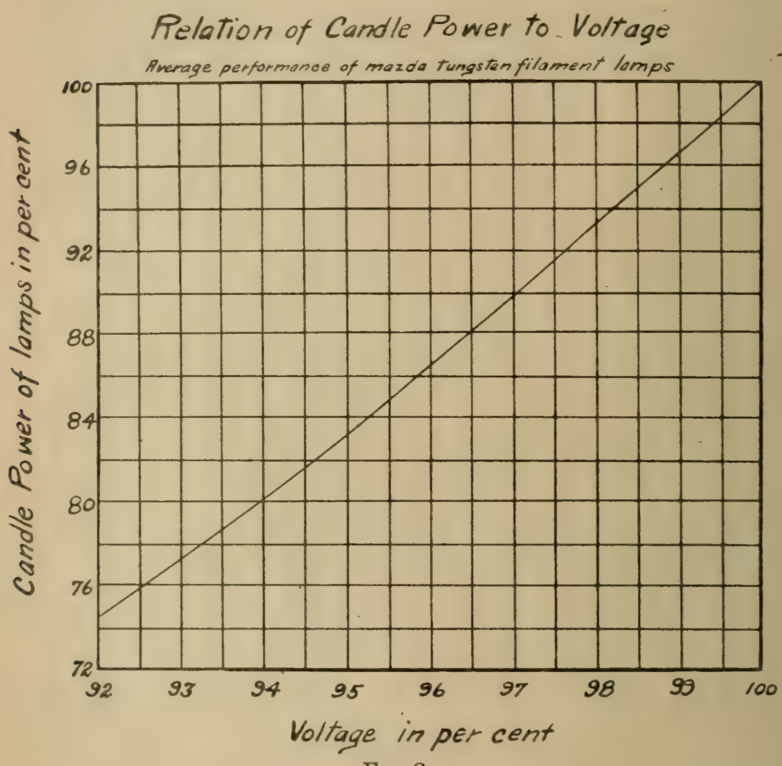


FIG. 2

Curve No. 4 indicates the effect of Voltage Variation upon Wattage and Current.

THE EFFECT OF VOLTAGE FLUCTUATION ON LAMP LIFE

It is suggested that when lamps are ordered, they should be ordered according to the socket voltage found in service or very closely thereto. These curves show the importance of correct selection of lamps according to the socket voltage. It is suggested that a large amount of educational work could be done along these lines by the Central Stations and that consumers be advised by some method of the correct voltage of lamps to buy. A tag left attached to all disconnected services, stating that "the lamps to

use on these premises are those of......volts rating," is one method of doing this which has been adopted. In certain cases it has been found

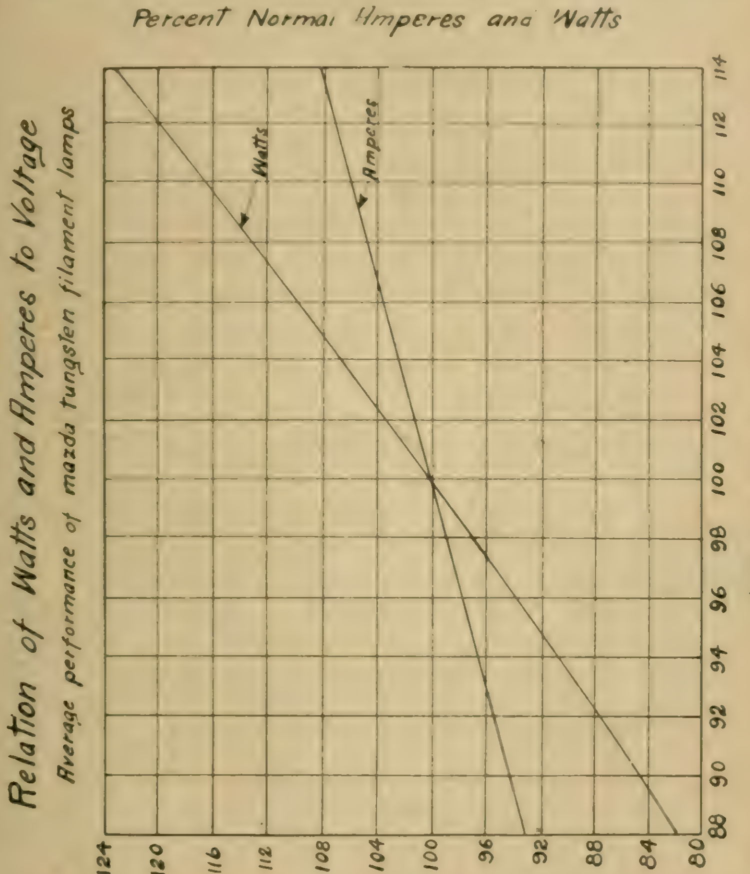


FIG. 3

advantageous for consumers to install regulators for their lighting load. This is a good practice wherever there is a fluctuation in incoming voltage that will affect the light and life of the lamp to any extent.

THE CARE OF LAMPS IN USE

As a general rule, after the lamp has been put into the socket it is given no further attention until the lamp is burned out. Under ordinary conditions, if the lamp is not cleaned frequently, dust and dirt will accumulate to such an extent as to reduce the light given out by the lamp to a marked degree. As a matter of fact, if the lamps are not cleaned, the loss in light giving efficiency may be from 25 to 30% for offices and stores. In factories.

needless to say, this figure may be much higher. A large Public Service Concern offers to its customers a lighting equipment maintenance service, and they have found that by maintaining lighting equipment once every

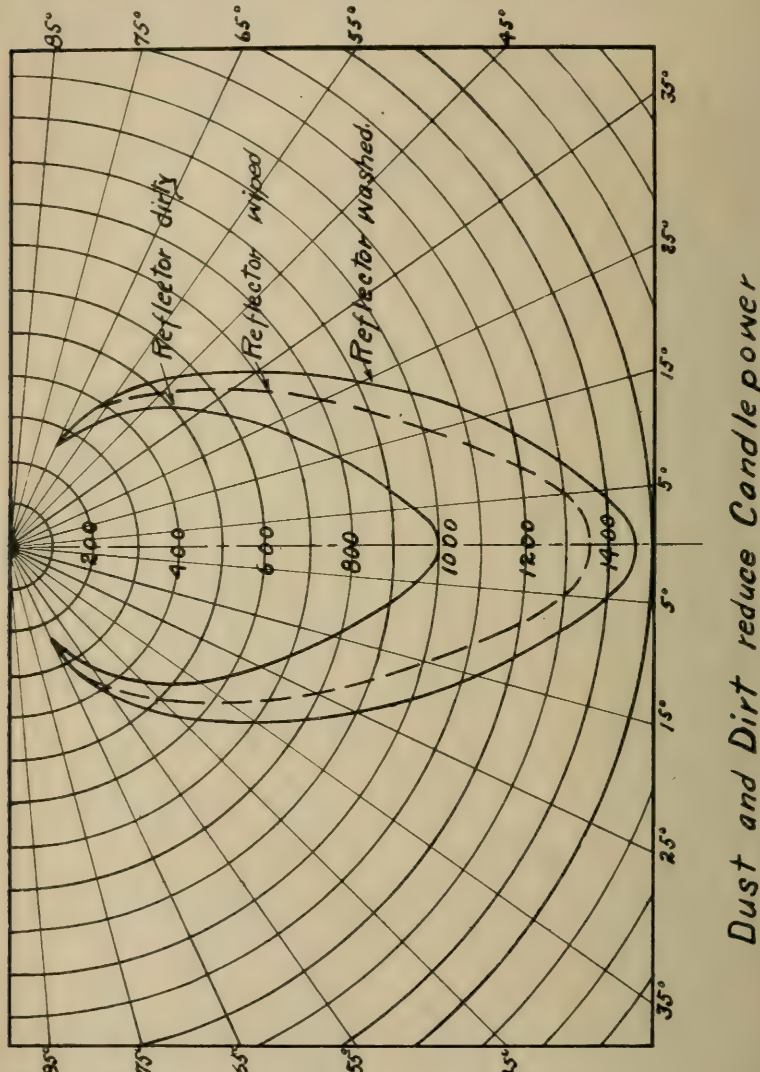


Fig. 4

month, the illuminating efficiency can be raised from 25 to 40%. The curves given below will show graphically the effect of the accumulation of dust and dirt and consequent loss of light.

THE USE AND ADVANTAGE OF A FOOT CANDLE METER

To-day there are many instruments in general use to measure certain quantities, such as temperature, weight, pressure and so forth, by definite

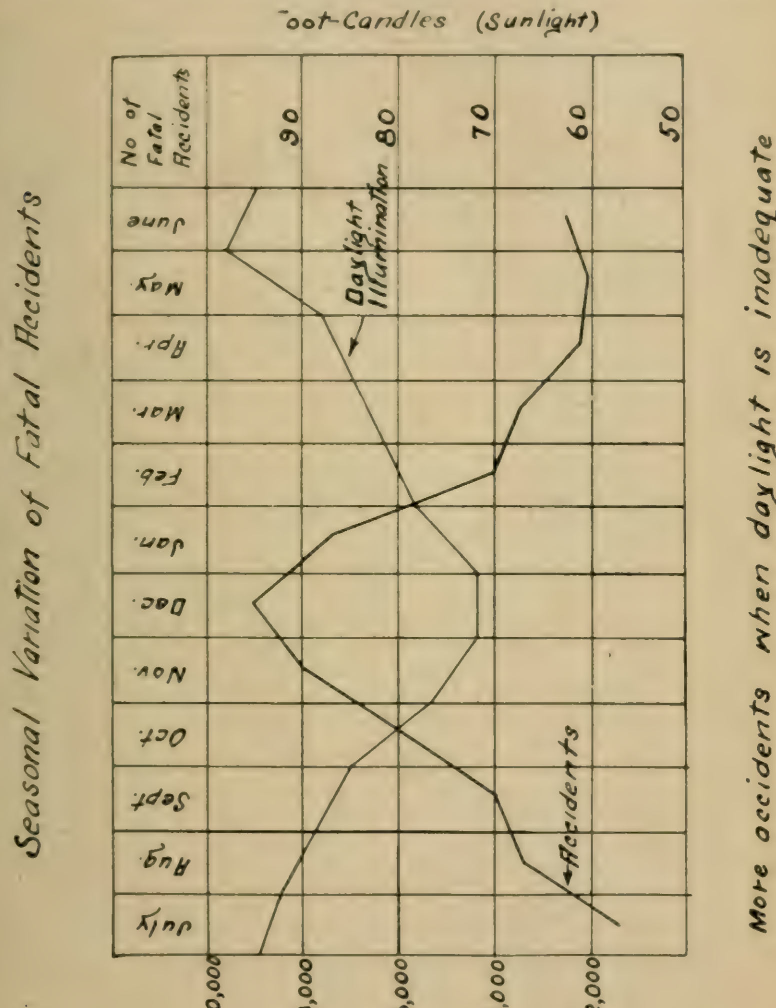


FIG. 5

standards. There has long been a need for a simple, compact, portable instrument to measure the intensity of light on any given plane, for factory, store, street and power-house lighting. A foot candle meter meets this demand. As a result, the light intensities of rooms, offices, factories,

etc., may be very easily determined by means of a foot candle meter. By very little experience a person may use the instrument accurately, the readings being direct in foot candles and no calculations being necessary.

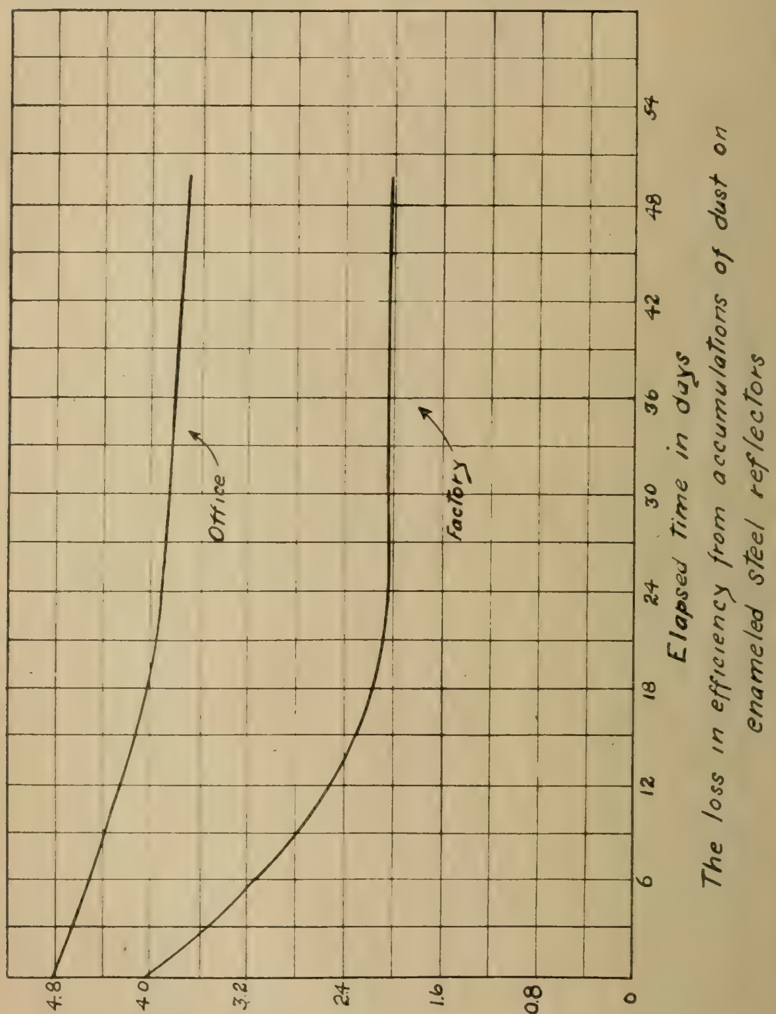
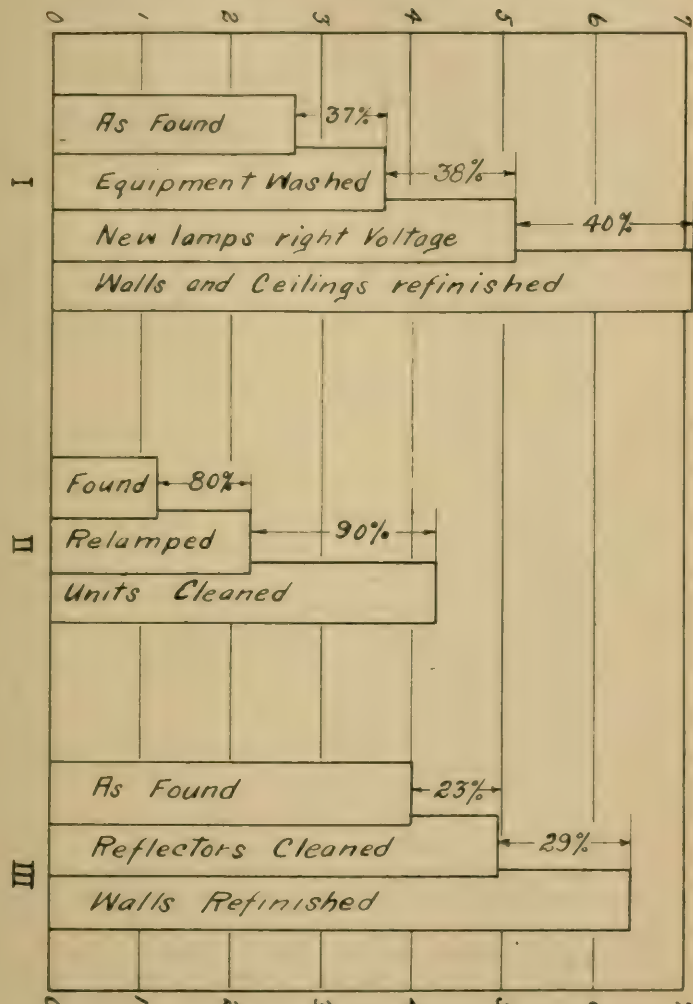


FIG. 6

During the last few years engineers in illumination have carried on extensive investigations to determine the proper light intensity (foot candles) for various kinds of work. For certain kinds of fine work a desirable intensity of illumination varies from 10 to 50 foot candles, while for general rough work 4 to 8 foot candles is ample. Tables giving desir-

able light intensities are easily obtainable, and as a result, a factory manager is enabled to study his own illuminating conditions with the aid of a foot candle meter and tables showing the desired foot candles. This instru-

LIGHTING INTENSITIES



Regular and adequate maintenance is necessary

FIG. 7

ment certainly should be used wherever artificial lighting is applied. By the use of proper light intensity production may be increased and accidents reduced.

The foot candle meter measuring 8″ x 6″ x 1½″ consists of a battery, voltmeter, rheostat, screen and standard lamp. The light from this standard illuminates the screen, one side of which is exposed to the external light source. The point on the scale that is receiving the same amount of light on both sides, appears to fade out, thus indicating directly the light intensity (foot candles).

THE USE AND ADVANTAGE OF THE MILL TYPE LAMP

Recently the lamp manufacturers have placed on the market a new style to be used for sign lighting as well as to meet the requirements of a lamp suitable to withstand a heavy vibration. For sign work the 25 and 50 watt Mill Type sign lamps have been developed in a blue bulb, which gives a whiter appearance to the light.

These lamps are made up in a P19 bulb, 4⅜″over all, this size accommodates itself to the troughs now in general use. As the lamps are vacuum lamps the bulb does not reach as high a temperature as gas filled lamps, thus reducing the breakage due to rain and snow.

In substituting these lamps for 5 and 10 watt lamps in sign lighting, care must be taken to see that the wiring is adequate enough to carry the load required by the Mill Type lamp.

For factory the 25 watt and 50 watt 110 volt grade and 50 watt 220 volt are recommended. For street car service 23, 36 and 46 volt lamps are available.

These lamps are about five times stronger at initial burning than the ordinary lamp now supplied for factory and sign lighting, and about ten times stronger at ¾ life. In order to get this added strength it has been necessary to reduce the efficiency somewhat. These lamps are recommended for use in any place where there is excessive vibration, or where the lamps have to be handled to any extent after they have been burned.

The coiled filament Mill Type lamp is rapidly replacing the old carbon lamp, as it is far superior to the carbon lamp in efficiency and approximates its quality as regards ruggedness.

While it is not a cure-all for many difficulties where extreme abuse is given to incandescent lamps, yet it marks a great advance, and will fully measure up to the needs of any reasonable service.

BETTER ILLUMINATION

Manufacturers, store managers, and executives are appreciating the need for better illumination. In practically all places where the application of light is carefully studied there is a demand for illumination of high intensity.

In a large department store an increase in illumination of 6 to 10 foot candles increased the cost of lighting 1% and increased the sales from 6 to to 7%. High intensity illumination in stores properly applied gives the customer ample opportunity to examine possible purchases carefully before buying, which naturally results in less returned goods and better satisfaction.

Faulty and insufficient lighting costs in the end far more than efficient illumination.

In the factory poor lighting reduces production and increases shrinkage—a loss of time and money.

With regard to general production in a plant, it is to be noted that an increase of four times the lighting intensity will equal a sum that is but a fractional percentage of the pay-roll, and the sum thus spent will be well repaid by measureable increase in production. More attention to illumination is only a matter of the possibilities of its service to industry being seen by responsible executives.

Lighting has power to stimulate, and where adequately used there is little chance for error, accident and idleness.

The experience of Cleveland among other cities is very interesting, as showing that crime is decreased by better illumination of the public thoroughfares.

LAMP SPECIFICATIONS

The Canadian Electrical Standards Association is working on the preparation of a set of standard specifications for Incandescent Electric Lamps.

The final report of the committee has not yet been completed.

NEW DEVELOPMENTS

The most important of the improvements has been that of the so-called Mill Type lamp which is designed primarily to stand rough usage. This lamp is especially referred to elsewhere in this report.

This ruggedness in lamp manufacture indicates the trend of the present lamp engineering practice. Combined with effort to increase luminous efficiency consistent with reasonable life is the constant endeavour to secure strength in constructions and reliability in endurance.

A most marked step forward is the production of the "tipless" lamp, thus removing the vulnerable point of the glass bulb. This is a feature, the economical introduction of which has been sought for for many years and its now successful application to production is a reward worthy of the efforts.

In the vacuum lamps with straight filaments, a wider spread of filament is being made by using supports of a different length and diameter, and so adding strength and the ability to stand up better against jar and vibration.

For Sign Lighting the 25 and 50 watt vacuum type with coiled filament have been produced to operate in a clear or a bluish bulb, thus approximating the effect of the higher wattage daylight gas filled lamp.

In Street Lighting practice there has been no general change. There is however a tendency towards increasing illumination intensities in an effort to reduce accidents and crime due to poor lighting. This has promoted the use of higher candle-power lamps, and there are now listed the 15000 lumen 1500cp) and the 25000-lumen (2500cp) lamps.

J. T. SCOTT
J. W. DUNFIELD
E. HOLDER
WATSON KINTNER, *Chairman*

SPEECH OF THE HON. WALTER MITCHELL, M.P., AT A JOINT LUNCHEON OF THE KIWANIS CLUB AND THE CANADIAN ELECTRICAL ASSOCIATION, CHATEAU LAURIER.

Mr. Chairman, ladies and gentlemen, when I came into this room a few moments ago, at the invitation of my very good friend who sits to my right, Mr. Julian C. Smith, of Montreal, I was somewhat dumbfounded to find three or four hundred people (and to me they look like ten thousand just at this moment. (Laughter)

I was told that I was going to have to make an address to one hundred and fifty to two hundred gentlemen connected with the Canadian Electrical Association. I consequently have prepared a most wonderful speech on electricity (Laughter). Now I am confronted not only with the electricians, and the good members of your Association, but with the ladies; so that I hardly know how to begin to tell the story that I am going to have to tell you, because I am going to drop that very, very good speech I had prepared and endeavour to make a few rambling remarks.

Mr. Chairman, before I proceed, however, I want to see if I cannot get even with my friend, Mr. Smith. Mr. Smith I have known for more years than I would like to tell (particularly since the ladies are here), but the first time I met Mr. Smith was when I first began to practise law. He came to see me one day, and he asked me if I wouldn't collect a note of his that he had, covering an advance he had made of $150 to a young fellow. I said: "Yes, I will collect it." I took action, and about every three or four days Mr. Smith would come to me and say:

"Mr. Mitchell, don't go so hard with that young fellow. Give him a little time."

I collected $25, $50, $75 and then $100. My friend Smith (who was a very successful engineer in a very big company in Montreal) then came in and said:

"I want to take that case away from you. You don't know how to settle. Why, you keep on collecting!"

I said I knew that, but as that was what he asked me to do, I asked him to explain.

"Why," he said, "every time you collect $25, that fellow who you are sueing comes to me and borrows it to pay you." (Laughter)

That is the good side of Mr. Smith.

Next time I saw him he said he was in great trouble. So I said: "What is the matter?"

"Well," he said, "I do not like to tell you."

I said: "You know, I never tell anything."

While he said it was pretty hard to tell, even he confided that he was in love with four women, and didn't know what to do about it.

I said: "Are they all right?"

He answered: "Fine."

"Don't you love one better than the other?"

"Yes," was the reply.

"Then, why don't you take the one you like best?"

To which he answered: "Because I am afraid the others will feel so badly." (Laughter)

"Well," I said, "I'll tell you. You bring the ladies down here and let me look them over, and I will decide."

I may tell you, ladies and gentlemen, that was the last time I ever saw Mr. Smith as a client.

Now, I have been delegated to tell you that the museum and all the other Departments are open to the officials and members of the Canadian Electrical Association. You are welcome to come and visit all these Departments; and I may tell you that after an arduous day's work, and after you have travelled around to all of those places, if you get tired and don't know what to do, and you feel like having a good sleep, come up to the House of Commons and we will put you to sleep in a short time. (Laughter)

Ladies and gentlemen, I am going to stick to my original text, for the benefit of the Canadian Electrical Association, hoping at the same time, Mr. Chairman, that my remarks may have some interest for the members of your very important Club.

I, as your Chairman has told you, have had the honour of being Provincial Treasurer in the Province of Quebec for a number of years, and in my capacity as Provincial Treasurer I had a considerable amount to do with the water development of the Province of Quebec. There is one feature, however, that I would like to call to your attention to-day, and which seems to me hasn't been advertised enough throughout the Dominion of Canada. We had, some twenty-five years ago, practically no developed horsepower in the Province of Quebec. At that time there was a gentleman who came from Boston (I refer to Mr. J. Aldred), to whom I cannot pay too high a compliment for what he has done for the development of water power in the Province of Quebec. I say that advisedly, because I remember distinctly when Mr. Aldred first came to the Province of Quebec and wanted to purchase and develop what is known as the Shawinigan Falls, on the St. Maurice River, all of the business men of Montreal, all the business men of the Province of Quebec, and the members of the Government, thought Mr. Aldred was going into an undertaking that he would never carry through. Mr. Aldred purchased the water power, he developed it, and to-day it is one of the assets of the Province of Quebec. Since then we (when I say we, I of course refer to the Province of Quebec) have worked in co-operation with the Shawinigan Water & Power Company, and in co-operating with the other different power companies that came along one after the other.

One day Mr. Smith came to us and he said: "We have one hundred thousand horsepower at Shawinigan. If by building a storage dam at the head of the St. Maurice River we could double that, would you not let us do it?"

After we checked up Mr. Smith's figures and plans, we said: "Yes, we will let you do it, but we want a hand in it." So we advanced the money, got the Company to agree to pay back that money to us, and charged them three hundred thousand dollars a year in round figures for the additional water power they got upon that river. Now, it is not generally known that this dam at the head of the St. Maurice River, at a place called La Loutre, is the largest storage dam in the world. The dam is built of solid concrete and has a total length of 1,646 feet, and a maximum depth of 90 feet. The area of the water surface varies between 200 and 300 square miles. I call that to your attention, 300 square miles of territory covered with water. You can imagine, by thinking of that, of the vast amount of power that is stored at the head of that river. The reservoir is 160 billion cubic feet.

The effect of the regulation afforded by this river has been to double the regular water low at Shawinigan Falls, the result being that whereas formerly they had 100,000 horsepower, to-day they have 200,000 horsepower the year round. That does not only mean that they have doubled the Shawinigan horsepower, but they have doubled the horsepower at every fall upon that great river, which has on it one continuous rapid after another. I do not think it can be estimated (probably the engineers have done so, but I have never heard estimate made of the enormous amount of water power that they will be able to develop). By financing this undertaking with two and a half millions of dollars, we have doubled the horsepower capacity of that great river.

Now, the importance of that is this, that we have learned our lesson. We know that by building immense storage dams on our great rivers, we are able to double the water capacity. When you remember that we have twenty-five million horsepower of water flow in this country, of which only ten per cent. has been developed, when you think of that, you can easily imagine that the day is not far distant in this country when we will be independent of black coal and be able to run our manufactories from one end of industrial Canada to the other with the "white coal" which is to-day being wasted, undeveloped. What we want to get in this country is capital to develop those water powers, capital to put into our industries. If our industries are built up with this capital, they will give employment to our labour, and employment to our labour will create population to consume what the man on the farm is producing. To me that will be one of the solutions of this great problem.

Now, to show you the importance and the connection between manufacturing and water power development, just let me give you a few figures to show the immense development taking place in the pulp and paper industry in this country, which is allied to the question of water

power developments, because these great pulp and power mills are situated, in our Province at least, on the water ways, and at the points where these water falls are located. You find that we have one hundred pulp and paper establishments in Canada to-day, whereas only a few years ago the pulp and paper work was all being done in the United States, to the south of us. We were shipping our pulp down there, and they were putting it into the manufactured state; but to-day we have one hundred of these establishments, with a capital expenditure of 347 millions, employing 30,000, wages 45 millions, cost of manufacture 126 millions of dollars, value of the product 236 millions of dollars. The result of that policy, in so far as Quebec is concerned, has been to make LaTuque a City of 8,000, I think now, Mr. Smith; Grand'Mere with 10,000 and Shawinigan with 12,000, practically small cities where formerly you had nothing but wilderness; and now have turned the town of Three Rivers, with a small, poor population, into one of the most thriving and industrious little cities that we have in the whole Province of Quebec. All that has been brought about by the co-operation of these great industrial concerns that have established themselves on the shores of these rivers, and in that way we have been creating in the Province of Quebec industrial centres which are giving employment to our labour.

I might refer to the St. Francis River, where I could tell you the same story again. There the water development has also been doubled.

Now, ladies and gentlemen, I have pointed this out for the purpose of making one argument, and one argument alone, that I believe the solution of all our difficulties in this great country is co-operation between all sections between capitalist, manufacturer, labourer and farmer. We have a great Western problem, those gentlemen of Western Canada have problems that are almost, it would seem at times, insurmountable. But we have our problems in Eastern Canada as well. We must not forget that we have just come through a World War, and that the great Canadian machine, like all other machines in all other parts of the world, is out of gear. All we have got to do is to get it back into gear, and it is by co-operation that we will get it back into gear. So I appeal

to those gentlemen of Western Canada, as I appeal to those of Eastern Canada, as I appeal to our good friends in Ontario, as I appeal to the people from my native Province, Quebec, to let us forget the difficulties of the past and only look to the problems of the future. I have enough confidence in my country. I know we have the resources of forest, of mine, of farm, and of everything else, because we have as rich a country as there is on the face of the globe. We have the people. All we need is co-operation and good will. Lloyd George, you will remember, during that period when, in the dark days of the war, went before the British House, when the Allies were differing as to leadership, and said: "The only thing we lack is unity." Unity is the only sure way to victory, I say, the only sure way of settling all our problems is unity. Let there be give and take. Let there be compromise, because I am certain there are no Canadian problems that cannot be settled by men of good will, sitting around a table, in a spirit of compromise and in a spirit of co-operation.

So I appeal to you, one and all, and ask for co-operation. I ask for unity. If we get that we will get the prosperity, the progress, the harmony that we all aspire to, for the everlasting benefit of our beloved Canada. (Prolonged Applause)

AFTERNOON SESSION, FRIDAY, JUNE 16.

P. T. DAVIES *in the Chair*

REPORT OF THE ACCOUNTING SECTION—1922.

To the President and Members of the Canadian Electrical Association:

Gentlemen:—Your Committee on Accounting now submits its Annual Report covering proceedings since the last Annual Meeting.

As Chairman of this Committee, I am pleased to report material progress. While the work upon actual accounting matters has been slow, our organization has been completed, sub-committees corresponding with similar sub-committees of the National Electric Light Association have been formed, and with our completed organization we should next year be able to take up the work at the stage now reached by our sister organizations, and continue to progress and develop along similar lines.

Many of our chairmen have received copies of the Proceedings of the corresponding National Electric Light Association Committee and several such chairmen have attended sub-committee meetings in New York, Detroit and Chicago, which have proved of interest, and their respective reports, when received, should contain valuable suggestions.

The Accounting Section has been instrumental in bringing into the Association twenty-two new members. These have been allocated among the following Committees:—

Purchasing & Storeroom Accounting:

Mr. W. A. Stitt, of the Shawinigan Water Power Company, Chairman.

Customers' Records & Billing Methods:

Mr. H. R. Lyons, of the Montreal Light Heat & Power Consolidated, Chairman.

Credits & Collections:

Mr. F. W. Fee, of the Ottawa Electric Company, Chairman.

Classification of Accounts:

Mr. W. Paxton Little, of the Canadian Niagara Power Company, Chairman.

Accounting Education:

Mr. Charles Johnstone, of the Southern Canada Power Company, Chairman.

Bonus Systems:

Mr. J. J. O'Brien, of the Quebec Railway Light Heat & Power Company, Chairman.

Accounts Payable:

Mr. F. A. Jansen, of the Ottawa Electric Company, Chairman.

It was suggested last year that member Companies should endeavour to standardize their accounts, and conform as closely as possible with the uniform system adopted by the National Electric Light Association. Your Committee repeats this suggestion.

The Report of the new Chairman of this Committee, Mr. W. Paxton Little, will undoubtedly bear weight. Mr. Little has been taking an active part in the work of a special Committee of Accountants called together by the Water Power Development Committee of the National Electric Light Association for the purpose of considering and criticizing the tentative rules and regulations for the establishment and maintenance of a system of accounts for licenses under the Federal Water Power Act of the United States of America. He is also a certified Public Accountant, State of New York, member of the American Institute of Accountants, and the National Association of Cost Accountants. I am sure you will agree that any recommendation from that Committee under his guidance will be very much along the proper lines.

This Committee, in its previous report, strongly recommended that the Chairmen of the Accounting Section and the Chairmen of the respective sub-committees should take advantage of the privileges accorded to attend Meetings of the National Electric Light Association Accounting Section and Committees. Much benefit would naturally accrue from the exchange of ideas, the expression of individual opinion and the consequent discussion. This Committee again requests Managers of Canadian companies to assist and encourage any of their members who may be Chairmen of Committees of the Accounting Section to attend Meetings in the United States, particularly as the policy of the various sections of the National Electric Light Association shall be to hold Executive Meetings in the different cities of the United States, and that the sub-committees of the respective sections shall have meetings called at the same time. This will ensure a good attendance at the Executive

Meetings, will create greater interest and keep the various chairmen in close contact with the work in progress.

D. R. STREET, *Chairman.*

CHAIRMAN P. T. DAVIES:—We have heard the report of the Accounting Committee, and would like some discussion on it.

Previous to taking up the discussion on this report, however, I understand that I omitted to carry on the discussion on the report of the Lamp Committee; and as one gentleman who wants to leave by the three o'clock train is intimately interested, I will ask Mr. Street to allow us to carry on discussion of the Lamp Committee report.

A MEMBER:—Mr. Chairman and gentlemen, after reading over this report I thought that I would have something to say about the superiority of incandescent over arc lights for street lighting, but last night I went to Mr. Ryan's lecture, and after seeing his "Thirty Dollar Exhibition," and hearing his remarks about it, I kind of forgot what I had to say about the question. I feel very much like the little boy who went to church with his father. The sermon was long, the day was warm, and the lighting scheme wasn't very good; and the parson, of course, was long-winded. After leading them through a long-drawn-out sermon, he thundered: "I only want to know what is going to become of the church?" The little boy, previously mentioned, whispered to his father: "Pa, tell him, and let's go home."

CHAIRMAN:—I am sorry I was away at the Lamp Committee report this morning, so I am unable to start any discussion on it.

E. A. STANGER:—I felt safe in advocating multiple instead of series lighting, not for one instance, but for a great many cases, for the fact that it does away with duplicate sets of wires on the pole structure, tieing up extra copper and apparatus and special transformers, but I too have second thought after hearing the lecture last night. It seems to me however that this is a point that might be gone into. I have in mind particularly the lighting on a street in Montreal, where the arcs are spaced probably 250 to 350 feet apart, and 30 ft. high. If you are driving on that street, east or west, at night when it has been drizzling, and one of those arcs is out, it is like diving into a black hole. With the subdivision of these high intensities and spacing at closer intervals, you don't get the same result if one of your units fails; and I am wondering just where you are going to draw the line between high intensity and lower intensity and great number of units. I thought some discussion might occur on this point.

CHAIRMAN:—I understood Mr. Stanger to tell me he was going to bring up the point of using mill type lamps.

E. A. STANGER:—That is particularly in connection with multiple street lighting, but it seemed to me that a lamp could be developed with mill type characteristics for street lighting service. We have a comparatively large number of multiple street lights in operation, operating through time and solenoid switches and one control wire. Due to the

fact that the pole will sometimes loosen up and be subject to blows and vibration, the Mazda B lamp does not render as good service as a lamp of mill type characteristics would. We have an extreme case in one of our towns, where we have small Mazda B's installed, and the breakage figures on these lamps are exceedingly high. We are trying the experiment of substituting a mill type lamp, and at the time it struck me that if a lamp of the same type could be developed in the higher wattages, it might find a good market for this class of work.

COL. STREET:—Mr. Chairman and gentlemen, I wish to draw the attention of this meeting to the new Stamp Tax Act coming into force, requiring stamps to be placed upon all receipts. This is a matter that should have the serious consideration of all Electricity Supply Companies, the point being: Is it necessary to give receipts; would customers be satisfied without a receipt; would they consider it sufficient, noting the amount registered or "rung up" on the cash register? Then, again: whether the cost of the stamp should not be charged to the customer. In bringing this matter to your attention it is my desire that it should act as a respectful suggestion to the in-coming Committee, that it should receive their consideration at the first meeting. If the respective members of the Accounting Committee seriously considered this before their next meeting, a recommendation might be soon made to member companies.

Now, gentlemen, before moving the adoption of this report, I regret having to say that once more the Accounting Committee must come before you with very little progress in actual accounting matters. In the past, comparatively little encouragement has been given to the committee, excepting possibly by a few of the larger companies, perhaps for the reason that in pre-war days financing was comparatively easy, not requiring statistics, or such detail of conditions as are now essential. The war has changed this. The high cost of operating and the dropping off in revenue have made it very necessary to have careful accounting, minute dissecting of costs, in order to provide necessary statistics. The Accounting Branch is now a most important one to every operating manager, in order that details of revenue and expenditure may be provided regularly. This possibly has been the reason why in the past year or so there has been an awakening among the companies and their managing directors as to the importance of the Accounting Branch. It was the lack of interest that prevented the Accounting Section from expanding more rapidly. Under the slight encouragement this Committee is now receiving, it has started out under good auspices, with the hope that the results of their work and research may prove of great value to members of our Association.

Last year it was found that there were practically no members in the C.E.A. belonging to the Accounting Section, none sufficiently interested to form the necessary committees and to make them effective. During the past year co-operation with the Membership Committee was effected, resulting in some twenty-two or twenty-three new members

being brought into the Association as members of the Accounting Section. These new members came principally from the East—Newfoundland sent in three names; Nova Scotia did particularly well, their most eastern section, Cape Breton, being represented; New Brunswick has also done well; and we have had strong support from the Provinces of Quebec and Ontario, principally the City of Ottawa. A good foundation is now laid to build upon, and we are therefore in a position to take up the work seriously, to synchronize with the Committees of the N.E.L.A., and assume our share of the burden that the members of our sister organizations have been carrying so well.

With respect to meetings: It is almost impossible to have a widespread membership and have such members present at meetings. It is consequently necessary for Committees particularly to do their work largely by correspondence. For the benefit of Managers and Directors of Companies, the duties of these respective Committees should be understood, and I now detail the work and ground to be covered by each Committee, in order that they may be on record.

Accounting Education Committee:

To select, prepare, publish and exploit among members suitable accounting courses for persons engaged in the industry; to recommend to member companies methods of encouraging the taking of such courses by employees.

Bonus Systems Committee:

To define the term "bonus system"; to investigate the status of bonus wages among central stations; to make detailed recommendations to the Association where actual experience has shown bonus wages a success in central station work; to study and outline theoretical fundamental requirements and characteristics for successful bonus systems.

To obtain detailed information about bonus systems now successfully in use. The work of the committee will be limited in general to those departments beginning with the meter readers and running through the collection of the account, together with allied clerical work. Salesman, power plants, linemen, etc., will not be considered in detail.

Classification of Accounts, Reports to Commissions, and Relations with other Associations Committee:

To secure the adoption by other associations of uniform standards in classification of accounts, in accounting methods and terms and in form of annual reports of utilities to commissions for the purpose of promoting clear understanding and efficient methods in such matters.

To secure the adoption of a standard classification of accounts by all member companies, to reach an agreement as to a national classification of accounts for all utilities, and to secure a general approval of such system of accounts by commissions.

To determine upon essential and desirable items to be included in the Standard Form of Annual Reports by Utilities to Commissions; to draw

attention to and eliminate inconsistencies and irrelevant matter in existing forms; and to secure the adoption of a standard form of report.

Credits and Collections Committee:

To make a thorough study of the methods employed in the Credit and Collection Departments of the various member companies.

Customers' Records and Billing Methods Committee:

To simplify and codify systems of Customers' Accounting Records for large and small companies, from cutting in of service to crediting of payments to customers' accounts, including meter reading and collections.

Purchasing and Storeroom Accounting Committee:

To devise and make effective efficient plans of organization and operation of purchasing and storeroom facilities, and accounting in connection therewith, from the origin of the need to the final disposition of the material, including the determination of inventory procedure.

It is clear that the Chairman of each Committee must devise plans along lines that are constructive, and must submit such plans to the member companies, asking such companies to criticize, and if possible submit other schemes. When data of this kind is obtained, the Executives of the Accounting Section, consisting of the Chairmen of the various Committees, could decide what plans could be submitted to the N.E.L.A. as the Canadian viewpoint. For this work funds are necessary. I would therefore respectfully urge the Managers of the Companies to do their best to encourage members, particularly Chairmen of these special Committees, to attend meetings of similar Committees in the United States. The Companies should pay the expenses of members attending such meetings.

As regards the meetings of the Executive: These are necessarily held in central places, and Electric Companies should encourage the attendance at these executive meetings, by paying the expenses of the members. The meetings might be held in Ottawa or Montreal; the latter place is naturally considered the best meeting place for reasons that are obvious. The expenses in attending these committee meetings can be decreased by the company or companies in places where meetings are held providing a place of meeting, either in the office of the company or elsewhere. The meetings in Montreal have been held at the Windsor. This costs money, which could be saved by one of the Electric Companies supplying a room. It is very necessary to have some funds to continue the interest, otherwise the membership will fall off. To my mind, a grant should be made by the parent association to assist the various committees.

Now Mr. Chairman, in conclusion, permit me to say that I appreciate very much the decision of the Association Executive, that it intends to appoint the Chairmen of the various Sections of this Association at the Executive Meeting to-morrow. This will enable Committees to settle down to work at once. It is a very wise move. I would however, request when the Accounting Section is being considered, that you select a new Chairman. I have not done justice to the Section in

the past two years, owing to being too much tied up with office detail. Undoubtedly a younger man, with a little more leisure, would be able to put more "pep" into the Accounting Section. I would respectfully ask therefore to be relieved, not that I wish to shirk work in any way. My hearty co-operation and assistance will always be ready for the Accounting Section. It is now very important the Accounting Section should be considered a fixture, the decks are now clear for action, and good work can be done during the coming year.

I have much pleasure in moving the adoption of this report, and I would ask Mr. J. Paxton Little to kindly second it. Mr. Little is from Niagara Falls, representing the Canadian Niagara Power Company. He is Chairman of the Committee of Classification of Accounts, which is a very important Committee, and in the report to-day your Committee have strongly recommended the adoption by all Canadian Companies of the N.E.L.A. Classification of Accounts.

I wish to thank you, Mr. Chairman, for having allowed me to encroach upon your time to this extent. (Applause)

W. P. LITTLE:—Mr. President and members, I have so recently been honoured with the appointment of Chairman of the Committee on Classification of Accounts in the C.E.A., that I have no formal report to submit, but I will, if you will allow me, read the report of the Committee on the Classification of Accounts of the N.E.L.A., presented at the Convention last month.

REPORT OF CLASSIFICATION OF ACCOUNTS, REPORT TO COMMISSIONS AND RELATIONS WITH OTHER ASSOCIATIONS COMMITTEE.

ACCOUNTING NATIONAL SECTION.

Presented at the Forty-fifth Convention of the National Electric Light Association, Atlantic City, N.J., May 15-19, 1922.

This Committee has held no formal meetings during the past year. Its informal activity has, however, been considerable.

At the annual meeting of the National Association of Railway and Utilities Commissioners, held in Atlanta in October, 1921, we submitted to that association's Committee on Statistics and Accounts of Public Utilities the N.E.L.A. amendments of the Commissioners' Uniform System of Accounts for Electrical Corporations. That Committee deferred its formal consideration of our propositions until its organization for the new administrative year should be completed. We were invited to present our arguments to the Committee at its meeting held in Chicago, February 20, 1922, and as a result of our presentation of the matter, it agreed to accept in substance practically all of our proposals for amendment. That Committee's report to its association will be submitted at Detroit in October next.

Last June it was learned that the statisticians of the public service commissions of some of the north-western states had held a conference for the purpose of considering the Commissioners' Uniform System of Accounts for Electrical Corporations. They submitted a joint memorandum to their several commissions in which they proposed sundry modifications of that system of accounts, some of which modifications were extremely objectionable in principle, and all in the fact that they involved deviations from the principle of nationwide uniformity. A vigorous argument against the proposed changes was drawn up, and, after approval by President Bump on behalf of the N.E.L.A., was filed with the commissions involved. In it we not only pointed out the objections to the statisticians' proposed changes, but we further called attention to the fact that if nationwide uniformity in the classification of accounts is to be secured, all proposals for amendment of the Commissioners' classification ought, before consideration by any individual commission, to be submitted to the appropriate committee of the Commissioners' Association. Our views were apparently concurred in. One of the states involved, the state of Washington, has since adopted the Commissioners' Classification, subject to such amendments as may be adopted by the Commissioners' Association after consideration of matters now before its Committee. The other two states have not yet acted in the matter.

The most important work done during the year by members of the Committee has been in connection with a system of accounts for the use of licensees of the Federal Power Commission. Representatives of that commission last summer submitted for consideration and as a basis for discussion a tentative draft of a system of accounts to be prescribed for use by licensees. Examination of the draft disclosed several objectionable features, principal among which were the rules relating to depreciation accounts. Study of the propositions relating to those accounts showed them to be substantially in conformity with the Power Commission's regulations relating to the depreciation reserve. In order to obtain a reconsideration of those regulations a memorandum was prepared and submitted through the Water Power Development Committee, and thereafter on November 21, 1921, a hearing was held by the Federal Power Commission, at which hearing representatives of this committee, as well as those of other N.E.L.A. committees, appeared and presented arguments on the subject of the regulation and rules relating to depreciation reserve and other like matters, and on the subject of annual reports to the Commission. No action has thus far, so far as we are informed, been taken by the Power Commission respecting our propositions.

Progress in securing the adoption of the Commissioners' uniform system of accounts by state commissions has been gratifying. We have before mentioned the State of Washington, and we are able to say further that the commissions of Utah and Virginia have adopted the system without change. Massachusetts has adopted a system in sub-

stantial accord, although with minor changes in verbiage necessary to conform to the Massachusetts statute. The commission of various other states have the matter under consideration, and there seems to be ample reason for expecting favorable action in several other states to become effective January 1, 1923. (Applause)

PRESIDENT:—It is necessary for us to keep our accounting men interested, so that the Chairman of this important section can get material with which to work.

We would like very much if we could get a uniform accounting system, particularly for the Hydro Electric of Ontario. If they would take over our system of accounting, we would be much happier.

Any discussion?

F. A. JANSEN:—Col. Street dwelt upon the importance of attending the meetings of the special committees and accounting section meetings of the N.E.L.A. Speaking from personal experience, I had the pleasure of attending a recent meeting in Chicago, and I know that I personally benefited a great deal by it. I attended the organization meeting of the Accounts Payable Committee, and being Chairman of this same Committee in the C.E.A., I would like to just briefly outline the report on the matters decided at that meeting.

The scope of the work comprises routine records and handling of invoices from the time they are released by the Purchasing Department until paid. It was deemed advisable that the study of the various forms, and also the methods as used should be carried on through the National Geographic Section Committee. And the results of the finding should be carried by their chairmen to the National Committee. From this data the material to be prepared for recommendation to the N.E.L.A.

Col. Street asked me also to briefly outline the work of the other committees, corresponding to those in the N.E.L.A. The following committees have been formed. There is the work of Standard Classification (we just had Mr. Little's excellent paper), the Bonus System Committee had to investigate status of bonus basis among central stations; then there is the Credit and Collection, to make thorough study of the methods employed in the credit and collection departments of the various member companies; then the Customers' Accounts Records, to simplify and modify system of Customers' Accounts Records and the Purchasing and Store Room Accounts. I think these are all the committees that we have formed to correspond with those of the N.E.L.A.

W. P. LITTLE:—I suggest the organization of the following Committees for the coming year which I understand have not heretofore been appointed: Fixed Capital Records; Security Holders Records; and Budget.

The first will cover a subject to which very little attention has been given in the past but which is of fast growing importance.

The second is especially important to those member companies who contemplate the sale of their securities direct to their customers or

the public, and the last would function on a very important and interesting work, for it would seem almost impossible for any well-organized corporation to get along without a proper Budget system.

The continuance of these committees in the N.E.L.A. for the coming year has been recommended.

CHAIRMAN:—Gentlemen, is there any more discussion?

A. A. DION:—Most of the Companies, when they issue bonds, go to a bond house. These bond houses want a lot of information, and if you have not got a system of statistics in your own company that is up to date, you will find the work very heavy indeed in preparing statements required by these corporations. I realize that very fully. I realize the importance of very full statistics, even to small details. Recently I was employed to investigate a Company which wanted to borrow two million dollars or so; I accompanied an engineer of the bond corporation. While that company does very general work (they are engaged in railway work, light, power and gas), I never knew any place where the work was so easy to perform. The work was extremely easy, because of the wonderful system of statistics in force, though it was not a large company. It was, however, operated under Stone & Webster, and they were following the system proposed by that Company. It was remarkable. There was a complete system of statistics, both financial and operating, which was audited each month, and this was really all we needed to investigate, outside of the examination of the physical property. I was so impressed with this that I would like to recommend to all companies the importance of keeping very full statistics, and if you do it in the way it was done there, monthly, it is not very heavy work, but if you don't do it, and you have, on sudden demand from your bond company, to produce these statements, it is very heavy work indeed.

CHAIRMAN:—We have yet a lot to do. If there is any more discussion, we would like to get it over as soon as possible.

If not, we will proceed to the report of the Accident and Prevention Committee. Our old friend, Mr. Wills Maclachlan, will present it.

(Applause)

REPORT OF ACCIDENT PREVENTION COMMITTEE 1922

Reduce Costs! Is not that the motto of present business? What part does accident prevention play in the programme? When an accident occurs there is the compensation cost, medical cost, overhead in looking after the details, destroyed apparatus, disorganization of force and lowered morale. To what gain? Nothing. These accidents can be prevented; are being prevented. How? By forethought and organization and combating this problem with the same methods that are used in combating any ordinary business problem. There is nothing myster-

ious. Well designed and constructed plant; capable and trained staff well lead together with real co-operation with a will to prevent accidents is the solution.

As well as the economic responsibility, the company has a moral responsibility. Destroyed apparatus can be repaired or replaced. What of a human life or limb? Compensate—yes. Replace—no. The human suffering as a result of an accident cannot be eliminated; it can only be mitigated. The families dependent upon men cannot be eliminated from the problem. They are the innocent sufferers of the accident and to them, and to society, management and men owe a great responsibility. To the children, industry and society owe the opportunity of being brought up under a father's care and protection. They too often are deprived of this as a result of an accident.

A public utility rendering to industry and society a great service can improve that service by reducing costs and increasing the usefulness of the lives of its staff by Accident Prevention and Health Promotion.

With the increased traffic on the streets, there is an alarming increase in the number of accidents. This, no doubt, to a very great extent is the result of lack of attention, both on the part of the drivers of vehicles and of pedestrians, but how much of it is the result of poor street illumination. It can be shown that the mounting height of street lights is as a usual thing much too low. For instance, street lights mounted 10 ft. above the curb decrease the discerning power of the eye by 50 per cent. due to the glare. Furthermore, tests conducted by the N.E.L.A. Park Laboratories have clearly demonstrated that intensity of illumination has a very decided effect on the quickness of observation, particularly in relation to the observation of moving bodies.

In putting forward plans for the street lighting of different Canadian Cities, Member Companies can render very considerable service in seeing that the illuminants are mounted high enough above the curb to cut out the glare and also are of sufficient intensity to illuminate the highway in a way that will render accidents less likely to happen. Tests can be presented, in fact have been presented, in reports of the N.E.L.A. showing that the most efficient mounting height is from 18 ft. to 22 ft. above the curb. It might be well to set up standard recommendations for street lighting; these being handled either by the Association or by the Canadian Standards Association.

Dealing with factory lighting, it can very easily be shown that a considerable number of the accidents in factories are due to poor illumination. Everyone is familiar with the bare lamp hung close to the machine, dark passageways, black shadows, etc. With the speed at which work in the modern factory has to be carried on, too much care cannot be given to the designing of the best type of illumination. This will not only work for the prevention of accidents in the factory but will also, as a general rule, increase the production of the factory both by speeding up and by the elimination of damaged parts. Member Companies can increase their service and incidentally increase their

earnings by assisting their consumers in the layout of good factory illumination either by supplying engineering service themselves or by directing their consumers to competent designers.

If the public utility company intends to advise the consumers as to the value of good illumination and also advise the municipal authorities as to this, it will of course be first necessary for them to see that their power houses, substations, store-rooms, offices and yards are well illuminated. This will not only be of good advertising value but will also be of value in increasing their own efficiency.

UTILITY DEVICES.

In advertising and selling different utility devices, the public utility company should make sure that these devices are safe. If this is not so, the device may work as a very bad advertiser for the use of electrical current. Many devices have been put on the market in such a way that although they were cheap they were dangerous, and the utility will be serving its own ends if it makes sure that the devices that it is selling and recommending are well designed and manufactured. Although your Committee perfectly realizes that nothing should be done to frighten the users of electrical appliances, yet it also feels that consumers should be instructed as to correct uses of these appliances. It is hardly necessary to draw to your attention the danger of using certain electrical appliances in bathrooms, the placing of electrical irons on stoves, etc. These points are readily appreciated by you but the average consumer does not realize the danger. The consumer should not only be instructed as to the use but should be cautioned as to the danger of amateur repairing of electrical appliances. These repairs, although simple, should be in the hands of someone who appreciates the danger of bad insulation, short circuit, grounding, etc.

DESIGN AND LAYOUT.

The matter of proper functioning of apparatus so that fire risks and danger to life may be avoided had been receiving considerable and increasing attention since electrical apparatus began to figure prominently in industry. There is one point, however, which even to-day is sometimes overlooked, and that is what one may term the personal safety of the operator in the normal execution of his duties. That this point is a most important one, both from the point of view of the personal danger which he might sustain and as far as the proper execution of his work is concerned, is obvious. Should any of his duties be such that personal risk is incurred, such duties are liable to be unwillingly or improperly carried out or even neglected altogether, while with the more conscientious type of man, the condition of nervousness brought about militates against the proper carrying out of the work. To any person engaged in making the layout of a plant or inspecting a plant, dangerous arrangements will be fairly obvious and would cover such a

wide field that it would be impossible to include them all. However, a few salient points may be mentioned.

Occasionally, generators and large motors of the horizontal type are so placed that it is impossible for the operator to feel the bearings when standing on the engine room floor. He has therefore to stand upon the bedplate of the machine in close proximity to its revolving field and there is some danger that in his preoccupation with the immediate business in hand, he may either come in contact with the latter or slip into the generator pit. In nearly all such cases, suitable hand rails from the frame of the machine to the pedestal would remove this source of danger.

Disconnecting switches are sometimes placed in such a position that they are exceedingly awkward to handle with a hook stick, and when endeavouring to do this, the operator may step backward or sideways into live apparatus which is all too adjacent or unprotected.

Fuses and fuse terminals on 2,200 volt instrument transformers are frequently placed in a dangerously accessible position, and the same can sometimes be said of the wiring on 13,000 volt potential transformers. While the matter of checking switchboard instruments does not normally come under the sphere of the operator, still it may be well to point out that the proper application of test links on switchboard panels goes so far to obviate the risks which are too frequently attached to this class of work that such links should be considered essential on all modern switchboards.

The operating mechanisms of circuit breakers are not in themselves dangerous, but it is always possible in a careless layout or where space restrictions are very severe, to put there breakers in such position that their automatic operation may endanger the operator. A line of exposed bell cranks and operating rods running at the rear of a switchboard is a case in point.

Swinging brackets on the end of the switchboards should be placed so that a man when walking upright can pass freely under them. On low voltage installations, bare conductors and copper straps are sometimes placed far too near the floor level. While clearances are always more than ample to prevent such conductors going to ground, rubbish which sometimes includes articles is frequently swept up on a floor and cases have occurred where an extra flourish with the broom has caused severe grounds and short circuit.

Knife switches are sometimes so placed that there is a danger of the operator burning his hands or his face when operating.

In conclusion it may be pointed out that in the large majority of cases, such dangers as have been indicated above are due far more to the arrangement of apparatus than to the apparatus *per se.* It therefore devolves upon the parties responsible for the layout of such apparatus to bear this point particularly in mind. However, even where this is done, where space restrictions are severe, it will frequently be impossible for even the best intentioned designer to lay out a plant which has not one or two bad corners in it.

USE AND CARE OF SAFETY APPLIANCES.

Safety appliances, unless properly selected, used and cared for, may become a menace rather than a protection to the user by producing a false sense of security.

It is therefore of the greatest importance that the proper use and care of these shall be generally understood.

(1) Rubber Gloves:—These should be purchased in accordance with the specification of the Canadian Electrical Association, or as near to it as possible.

A soft and flxible glove is desirable, as they are easier to work with, and therefore it is less difficult to get workmen to use them. Leather slip-overs should be always used to protect the rubber gloves from mechanical injury and in some cases a thin silk or cotton glove is used inside of the rubber glove to advantage. Rubber gloves should be worn when working on live wires, carrying current at potential above 220 volts. When not in actual use they should be kept in a box, separate from any other tools, so as to be protected from mechanical injury.

They should be inspected and tested at regular intervals and a record kept of the performance of each individual glove.

(2) Lineman's Shields:—There are several makes to be had, all of which are satisfactory. They are very desirable for use where there are several circuits on a pole and it is necessary to work on one of these when the others are alive. When not in use they should be kept in a cool and dark place where there is no chance of mechanical injury.

(3) Insulating Stools:—These are usually made by using pins of the lags of a low stool or platform and putting insulators on the pins. They should be of solid construction and so arranged that stepping on the edge of the platform does not tend to upset them.

They should be used by all men working on a "live" switchboard and trimming arc lamps, etc., except when a special wagon with insulated platform is provided. Along the same lines are the so-called "Safety Islands" as used at patrol telephone stations. These consist of a platform about 18 ft. square firmly attached to the top of a high tension insulator and suitably mounted on a bracket or method of the sort.

They insulate the patrolman from ground when he is using his phone attached to telephone wire which run below or parallel to high tension wires and protect him in case of potential in the phone line, due to disturbances on the system, or accidental contact between phone and power lines.

(4) Insulating Mats on Platforms:—These may be rubber mats or good linoleum or in some cases a slatted wooden platform and should be provided in front of all switchboards where there is a chance of any of the parts becoming alive, due to breaking of switch mechanism and parts of some coming in contact with the bus or other "live" parts, or the breakdown of contract or potential transformers, etc.

Life of rubber mats is about ten years under hard service; linoleum about the same.

(5) INSULATED HANDLES ON TOOLS:—The use of these is not to be recommended, since they are very frequently damaged mechanically by being dropped off poles, and then, if depended on, become a hazard rather than a protection.

Along these lines the advisability of the use of "weather proof" or other insulation on 2,200 volt wires on overhead lines may be questioned. After a few years of exposure to the weather it loses its insulation properties to a great extent and becomes a serious hazard, as there is a tendency to regard a wire so covered as insulated and to treat it accordingly, when actually it is as dangerous as a bare wire. This applies particularly to the general public in a case of a wire falling to the ground. If the wire was bare of insulation it would be treated with more respect.

(6) FUSE TONGS:—These are fibre tongs and are usually provided with slots of several sizes to handle various sizes of fuse. They are especially desirable where a type of fuse having "tell tale" is used, since severe shocks are sometimes received from these when they are removed or replaced with the hand.

(7) GROUNDING DEVICES:—This refers only to portable grounding devices, and not to permanent apparatus in power or substations.

The most suitable device has been found to be a braided soft copper wire of No. 6 equivalent made of a large number of fine wires, about No. 28. This is light and small even when 100-ft. lengths are used. When used, one end is first attached to a good "ground" and the other end to a hand line. The hand line is then thrown over the wire or wires to be grounded and the copper strand pulled tightly over and the other end also attached to the "ground." In removing from the line the last thing to be disconnected is the end first grounded.

(8) SAFETY BELTS:—These should be in accordance with Canadian Electrical Association specifications. They should be inspected from time to time and preserved by cleaning and oiled with neat's-foot oil.

(9) PROTECTIVE GOGGLES:—These should be worn by all engaged in any grinding operation such as using a commutator truing device, etc., to protect the eyes from chips. They can be had in almost unbreakable glass.

Where a man has to examine a commutator which is sparkling, it is advisable for him to wear colored glasses to protect the eyes from the glare of the sparks, etc.

ACCIDENT PREVENTION ORGANIZATION.

Your Committee from their experience considers that one of the most successful means of preventing accidents is to put the job up to the foreman or the person immediately in charge of th working staff. Our experience has proven that, to start with, the employees should be addressed by some competent person who will thoroughly outline the accident prevention scheme and particularly point out to them the large number of accidents which means a large amount of suffering on the

part of the victim, inconvenience and expense to those who have to look after the patient and the huge waste of money in lost and unproductive time. The foreman should have it impressed upon him that they are the ones who have not only to get production from the staff immediately under their care but that the work must be done in a safe manner and that if accidents occur they are simply creating another avenue of expense which it is their duty to prevent.

Foremen should be cautioned that they should not retain in their charge employees who are unsuited for the work which they are doing and also men who have careless habits and are likely to endanger the lives of themselves or others.

A great many foremen have, in the past, been chosen for the positions, not because they displayed any unusual ability in their work or in the handling of the staff, but simply because they were old employees and it was considered they should have been given the chance for advancement.

If a foreman does not produce enough work from his staff, or does not do it properly, he is promptly removed from that position and we consider that a man who does not carry on his work safely and has a large number of accidents with his staff, should also be removed from the position of foreman.

Let us impress the fact that in order to get results in practically any organization, that every official must do his part and let the staff know that they are behind any accident prevention movement and in order to do so they must show their interest in some way.

The foreman or immediate supervising official is the one and only person who can successfully instill accident prevention into the minds of the staff and it is there that the greatest amount of good can be done.

HOW TO HOLD THE INTEREST OF EMPLOYEES IN ACCIDENT PREVENTION.

When safety work is first begun in an organization, there is usually a good deal of enthusiasm on the part of the employees as well as those in charge. This is partly due to the novelty of the work and also to the many interesting features which are part of this work. In a great many cases, as they become familiar with some of the phases of accident prevention work, they become careless, and it is usually through this momentary slackening of interest that serious accidents take place. It becomes imperative, therefore, to keep the interest of employees always focussed on the great importance of safety work in order that the good results obtained in the early stages of the movement should not be lost at a later period. Among the chief ways of keeping the interest might be mentioned the following:—

1.—It is absolutely essential that anyone in charge of safety work should be himself thoroughly interested in his own work in order to impress upon others the same degree of confidence and enthusiasm, and should at no time show any signs of losing interest in the work.

2.—Lectures with demonstrations should be held at regular intervals.

3.—Regular inspections of installations, safety devices, as well as the training of the men should be carried on.

4.—Bulletin boards should be placed in prominent places in plants where employees can see them.

5.—Competition work amongst teams or departments should be encouraged.

6.—Rewards for successfully carrying on safety work to whom credit is coming due.

7.—Results in the improvement of conditions and benefits accruing to everyone should be shown to employees.

HEALTH PROMOTION.

The public utility industry realizes quite well the necessity of preventing accidents to its employees and has spent a considerable amount of money and time in developing measures for the prevention of accidents and minimizing the amount of lost time from this cause. This activity on the part of the public utility industry has been rewarded by a considerable saving in the amount of compensation paid and in the more efficient operation of its plants by removing to a considerable extent the hazard existing where use is made of the educational means or of the means of engineering revision.

Taking the data supplied in the 1920 N.E.L.A. Report, it will be seen that for one day lost time due to accidents, there are 4¾ days lost time due to illness. Quite authentic figures show that from six to nine days per year are lost by every man, woman and child due to illness. This is a considerable drain on industry, even although in a number of cases salary is not paid during the period of absence on account of illness. The disorganization of the work by employees being absent due to illness is very considerable.

Employers of large bodies of men realizing the loss in production and efficiency have taken measures to prevent illness (as far as possible) among the staff, and where illness does occur try by all means to render the period of disability as short as possible.

The smaller companies have not, as a general rule, put such measures into effect, due primarily to not realizing the situation and also due to a mistaken idea that the costs of such an activity are prohibitive and that it is rather the action of a philanthropist than of a business man. There is no doubt that the employees will receive a very considerable benefit from carrying out a programme of health promotion in any industry, yet the industry will itself receive also very considerable benefit by the reduction of the time lost due to illness and also by the better efficiency of the employees on account of better health. In the public utility industry, the accident hazard is higher among the field staff and the operating staff. It will be found that the sickness hazard is higher in the clerical staff and those particularly working indoors.

Fairly complete details as to staff, physical examination, statistics, circular letters and co-operation with outside bodies, are given in the 1922 N.E.L.A. Accident Prevention Committee's Report. Those who are interested in the subject will find here many things of interest.

CONCLUSION.

In conclusion, successful accident prevention must be part of the work of the Company and not a frill. It must have the support of the Board of Directors and the chief executive, as upon them is the responsibility of economical management. Such management will not tolerate the preventable economic waste nor the suffering to wives and families. The staff must realize that by team work accidents can be eliminated; all must feel that an accident is something, not only to be sorry about but to be ashamed of.

JOHN L. COLLINS.
C. B. COOPER.
A. P. DODDRIDGE.
J. W. DENFIELD.
L. A. KENYON.
J. T. LAMBERT.
V. LAURSEN.
J. H. MARTIN.
J. PALMER.
EUGENE VINET.
WILLS MACLACHLAN, *Chairman.*

In connection with the report, I think it was rather fitting that we should follow the Accounting Section, because of the fact that throughout the report we point out the economic value of elimination of accidents. Accidents cost money. If you can cut them out you save. That is the first part of the report, leaving aside entirely the humanitarian interests which we all have.

We also touch upon the effect of lighting on accidents, question of the utility devices: and these devices I would ask the commercial men to look into carefully before new devices are put on your lines. In connection with layout and design, we point out some details that should be taken into consideration.

In connection with safety devices, we have got a number of them here. It was thought better to bring the devices here and let you look at them, and to talk about them. You can examine the devices in detail, the bulletin board, the oil done up for quick use, the rubber gloves, signs, etc.

And then we touch on the question of health promotion in the report, but practically all this is covered in the N.E.L.A. report.

I must apologize for not having been able to give more time to the Canadian Electrical Association Committee this year, but for three

years now I have been secretary of the N.E.L.A. Accident Prevention Committee, which required a lot of time. I would like to refer you to a number of details in the N.E.L.A. report which might receive a great deal of attention. There have been a number of meetings held in New York. Men have come from the far west to attend these meetings. I think we have most of the large utility organizations in the United States represented on the Committee, and those interested either in the design, operation or management of the utility, I would direct to the details of the N.E.L.A. Report.

Another point that I wish to bring up at this time, possibly not dealing with the Accident Prevention, is that the National Electric Safety Code, which you know has been developed steadily since 1914, has now, at the Atlantic City Convention, in an open meeting of the Technical Section, been approved by the N.E.L.A. I think that is a great step to advance the feeling and common cause of the power companies, the signal companies, railways, and all the other different factors interested.

I don't want to take any more of your time, excepting to introduce to you a man whom we call our attorney in accident prevention work, who is looked upon more or less as the chief of accident prevention work of public utilities in the United States. Mr. Scott comes to us from the Bureau of Safety of Chicago. That is the accident prevention organization of the Insull interests. He has also been connected with the Accident Prevention Committee of the N.E.L.A. from its inception, is Vice-President of the National Safety Council and Chairman of the Accident Prevention Committee of the American Gas Association. I don't know that I could bring to you any man from the United States that could speak to you on accident prevention with the authority of Mr. C. B. Scott, who I have great pleasure in introducing. (Applause)

C. B. SCOTT:—Mr. Chairman and gentlemen, I have had a good many complimentary and undeserved introductions, but I think Mr. Maclachlan made it a little too strong. I have a great pleasure in attending this, my first meeting with your Association, and that I feel quite honoured in being invited to appear in your programme.

I have another source of pleasure in coming, and that is my long and intimate association with the Secretary of your Association, and with Mr. Maclachlan, both of whom have been of great assistance in the development of the particular work in which I am engaged for the National Light Association, and to whom a great deal of credit is due for anything that may have been accomplished along the line of accident prevention by that organization.

I have another pleasure, Mr. Chairman, and I suppose it is referred to by everybody who happens to come across the line, and that is up here we are permitted to have certain privileges which our Constitution forbids, but unfortunately I did not know the way, and I was routed wrongly, and I did not come through Montreal, so that may largely account for the sobriety of my remarks.

I notice that no assignment of any particular subject was made to me. I asked Mr. Maclachlan after I arrived just what I was to talk about. He said it did not make any difference. He knew, no matter what the title should be, my remarks would be along the same lines, so that a title was immaterial.

Down our way, not long ago, a certain municipality placed all of its employees under Civil Service. New applicants as well as old were required to pass a written examination. Among the applicants was an Irishman, who was applying for the position as Superintendent of the Dog Pound. He got his list of questions, ran down them, and found the question: "What are rabies and what would you do for them?" He scratched his head and wrote: "They are Jewish priests. I wouldn't do a damn thing for them." (Laughter)

Mr. Maclachlan has referred to the fact that I am connected with the Bureau of Safety in Chicago. I presume you know Chicago. I was told that not long ago a very flashily dressed and nervous citizen of Chicago went into a telephone booth in New York and called up Brooklyn, and when he got through he asked the young lady what the charge was. She said 10 cents. He was indignant and said: "Young lady, do you know that I could telephone to hell and back in Chicago for a dime?" "Sure, you can," she replied, "that's in your city limits." (Laughter)

The Bureau of Safety was originally organized as the safety department of one of the Insull interests, which was composed of a group of properties well scattered over the country, and in that respect not unlike the properties that go to make up your own Association. These properties were located in as many as 18 States. Afterward this department was enlarged and made to take care of all of that particular interest (by interest I mean financial interest), so that at present this Bureau of Safety has to do with about 28,000 employees, and looks after the safety of all of the employees in the electrical, power and distribution business, and electric railway business, in various communities, including therein such large companies as the Commonwealth Edison Company, and the People's Gas, Light and Heat Company, of Chicago, so that the Bureau, by reason of its touch with properties, large and small, and operating under almost every imaginable condition, would perhaps give us a view of accident prevention that is to our advantage in determining what might apply in most any case, and under any situation.

With your permission, I shall try for a few minutes to discuss the subject of *why* and *how* accident prevention should receive your attention, and as evidence of my appreciation I promise you that I shall not talk longer than 20 minutes, so that you may be perfectly at ease and know that this infliction will soon be over.

The work of accident prevention has suffered most because of the manner in which those who specialize in it first went about it. Accident prevention ten years ago would have secured a much better hold upon

you, and men occupying positions such as you occupy, if at that time those who were trying to interest you in it had emphasized this fact, "That accident prevention was an integral part of good operation, designed to operate it more economically and efficiently." Instead of that it was presented in a rather spectacular way. There was too much publicity, and pictures, and entertainment, and those things which did not seem to fit in with the practical, hardworking business of producing and distributing and selling power. This Bureau is in close contact with and is co-operating with the Operating Departments, and fitted together so that its recommendations, its counsel, its advice, its work, is so intermingled with operation and construction that you could hardly find the line of demarcation. Every operator, every manager within a particular plant counsels with us regarding the most efficient and economical operation of his plant from the viewpoint of safety. In that way we have built up an interest that is not dependent upon such things as pictures, and bulletins and buttons and dinners and smokers and speeches. The man who is working in the Operating Department appreciates that safety is very closely interlaced with his own work, and it is for his own benefit and in that way I think we have accomplished our best results.

Another mistake has been that accident prevention has not been presented as it should be, on a sound economical basis, as a really money saving proposition. We who have specialized know that it is difficult for us to do that, because it is not the side that is most appealing to us as a measure of necessity. I want to give you a few illustrations to show you that it is economical when applied in a business-like way, and that the financial results are really worth trying for, if there was nothing else involved in it except the saving.

I recall two companies presenting good examples. One is the Chicago North Shore and Milwaukee Railroad, an electric line from Chicago to Milwaukee, one of the largest inter-urban properties in the country. It runs through a very congested residential territory, a dozen or more north shore towns very thickly populated by the business men of Chicago, where there is a great deal of automobile traffic. That road, five or six years ago, was in the hands of the receiver. It passed out of the receivership into the hands of other interests, and the new management put in a definite systematic plan of accident prevention, plans that involved the operating methods of the road, plans that required the care of every man connected with the property, and of careful supervision. The organized effort on that road produced a reduction in accident costs of $56,700. That reduction has been not only maintained, but proportionately decreased over since. To-day the Chicago North Shore and Milwaukee Railroad is the safest operated road in the United States, and it has all been done in a period of about five years.

Another illustration, not quite so marked, but one which I think will help to convince you of the fact I have in mind. In the five years

before the Commonwealth Edison Company adopted a systematic plan of accident prevention, the number of fatalities to employees was 33. I was told that considering the number of employees, namely about 5,000, that the ratio was normal, that any property engaged in that business, employing from five to six thousand, might reasonably expect to have about 33 fatal accidents in five years. However, a systematic plan, which contemplated not spectacular or spasmodic effort, but the line of endeavour that I referred to was installed and in the succeeding five years, instead of having 33 fatalities, that company had 12. Now this was not an accidental reduction. It showed just what could be done.

I want to speak for a minute about the "how." This talk is going to be rather general, because I am not going into the technical side of accident prevention. I just want, if I can, to leave some word with you that will convince you that accident prevention is something that should receive your attention, and if I can, to give a few essentials as to how to apply it.

There is one fundamental necessity in every company without which no expert, I don't care how well trained or competent he is, can succeed. There is one first requisite in accident prevention that is absolutely essential and that is the interest of the chief executive. I don't care how many competent safety men you may employ. I don't care how hard they work at it. If the chief executive is indifferent towards safety, you might just as well close down that department so far as good results are concerned. I would not jeopardize my reputation, if I have any, by taking employment in any concern where I didn't have the backing of the chief executive. That is the first thing to be done, and that is the first "how."

The second is this. You cannot, in your business, put across any important activity unless you give proper attention to organization. It is the vehicle with which you carry plans to a successful conclusion. You have organization in your accounting department. If you are going to sell securities to customers you must provide an organization. It is not organizing to employ a man and say "Go to it." That isn't the way. Every operator, no matter how large or small his property, must provide some sort of a common sense business-like organization that will assure continuity of effort in accident prevention. The man that once a year makes a great big spectacular effort towards accident prevention, and tries to make his men believe that it is going to last a year, is just wasting his time.

Here are two plants, one on my right and one on my left. The one on the right has a safety man who is called an expert. He is in touch with the Safety Council, National Electric Light Association, and other bodies actively engaged in his work. He gets their literature, posts the plant with bulletins, makes speeches, pins buttons, gives entertainments, and his manager pays him a salary and lets it go at that.

The plant on my left, that has no so-called safety man. It has a

manager who believes that safety is an economy and a matter of efficiency, and knows it is important. He organizes within his plant a committee of three or five, and says: "You must meet every thirty days and consider the problems and hazards that come within the scope of your duties, and you must have inspections of your property made, and you must do this and that." There is no publicity, no demonstrations, buttons, speeches. To my mind this is the real safety plant, where they make safety a part of the every day duties of each man who is in that industry. I should say that was the plant that was most proficient in safety.

There are two or three other elements (I have talked about 15 of my 20 minutes already) that are essential after your organization is perfected, and now again I come to purely operating matters. The most important duty for an organization to take up, after it has been formed, is close supervision, enforcement and obedience to rules. I am talking about essentials today. I am not touching on little things There is too much laxity in every plant in the enforcement of rules. There is too much disregard for the rules that hang printed on the wall. The first duty of your safety organization is to secure closer supervision of work, and more rigid enforcement of fundamental safety rules.

Mr. Maclachlan referred to safety devices. You take a great deal of interest in the type of safety devices. You talk much about some particular kind of glove that your linemen shall wear. It is proper that you should give your attention to these things. But the trouble is not in the design of the safety device, so much as it is in getting the man who needs it to use the safety device provided, and if you give more of your attention to seeing that the men use the safety devices and less attention to the technical discussion of the make-up of it, you will get further along with your safety work.

There is too much of taking things for granted. Nearly every time I have a man killed for not wearing gloves, investigation discloses that the man was killed with his gloves tucked in his belt. If I get opportunity to talk to his superintendent, the latter will say: "I always thought he used them. I didn't know he worked without them." But the chances are that for months that fellow has been accustomed to do without them. The other day I attended an inquest where a lineman was examined with reference to a fatal accident. His superintendent was quite emphatic in saying his men used their gloves. The lineman was asked "Do you wear rubber gloves?" The answer was: "Why, that's kindergarten stuff." Yet his foreman thought he was a good safety man and the superintendent was sure all employees obeyed the rule which required them to wear gloves. (Applause)

CHAIRMAN:—Before we go on with the discussion of this paper, I am sure you agree with me that Mr. Scott is entitled to our very best vote of thanks. When he started off on the consideration of the economics of the situation, I felt his heart wasn't in it, as I feel sure you all

did. But the last few sentences explain to us just why his heart has been in it so long.

It is a terrible thing to know that such buildings as the Mount Royal Hotel in Montreal, because it is a four million dollar building, has got to have one thousand accidents, and got to have fifteen deaths. A man told me that the other day, and now I check them off as they go through the newspaper. I suppose it will reach the fifteen, because we fail some way. Insurance, it seems to me, is a poor way out in every sense of the word. The insurance company has not the heart behind it. They can collect the money sufficient to cover the risk, and they will do it. It isn't for them to recognize this humanitarian viewpoint. Too many people when they have gone to the trouble of covering themselves with insurance figure they have done all that is necessary. I am perfectly sure of it after hearing Mr. Scott's wonderful address.

A. A. DION:—I have very much pleasure, Mr. Chairman, in moving this vote of thanks, because I feel that I have heard the best sermon on safety which it has ever been my privilege to hear. Not only is the material excellent, as it must be from a man of his experience in that work, but the manner of telling was such as to impress us so deeply that we will carry the effect in our minds a long time, I hope long enough to follow some of his advice and profit by it, and practise in our various companies the advice which he has given us. I call for a vote on this, which I know will be unanimous. (Applause)

CHAIRMAN:—We have a short time in which to ask Mr. Maclachlan any questions, if you want to. Perhaps some of the apparatus has not been properly explained. Each one of us is supposed to have seen it and looked it over. Are there any questions regarding the apparatus on view, or points on the paper? I will be glad to get them just as quickly as you can.

E. A. STANGER:—One point that has been discussed before, question of using insulated wire on the primaries. It has some value in the beginning, but I think it is false security, and I think it is a point well worthy of considerably more discussion than has been given to it.

W. MACLACHLAN:—I would be delighted to start in on any scrap on that question. In cities you can hardly use bare wire, but in the country you most certainly can. The linemen have got to have impressed upon them that weatherproof wire is not insulated, and that if they use their gloves there is no danger.

Be sure to do one thing, teach your men resuscitation, and make them practise it. We have from 150 to 200 lives to our credit in the last seven years. That is a big thing in public utility work.

CHAIRMAN:—We have a paper left over from this morning, and I will ask Mr. Trimingham to read the report of the Inductive Interference Committee.

We have with us Mr. W. J. Canada, of the N.E.L.A. I would ask you all to wait until Mr. Canada at least is through.

Report of the Inductive Interference Committee

Early in 1921 the Canadian Railway Association approached the Board of Railway Commissioners for Canada with the request that they consider the formation of a set of rules and regulations controlling the physical relations between electric power and signal circuits. The Canadian Electrical Association were asked to express their views by the Board, and your Committee informed them that, inasmuch as a Joint Committee of the National Electric Light Association and the American Telephone & Telegraph Company had been appointed with the same end in view, it was desirable to wait until the findings of this body should be made public; particularly as the subject was being dealt with by a very large Committee having permanently employed consulting engineers acting with them.

With the idea of co-ordinating the electrical interests as far as possible, the engineers of the Hydro-Electric Power Commission were communicated with, and they replied that they would be pleased to act at the opportune time. It cannot be too strongly stated here that it is most desirable to have any legislation that is to be enacted in Canada on this question formulated by one body; preferably with Federal authority, in order to obtain uniform rules to serve as a guide to the several Public Service Commissions, and thus prevent confusion, for Companies which might be operating in two Provinces. In order to obtain an idea as to the extent of the inductive interference problems among the Class A members, the Questionnaire shown below was sent out with a letter asking that it be completed in so far as it applied to power circuits of 13,200 volts and over which were involved with signal circuits :—

C.E.A. INDUCTIVE INTERFERENCE COMMITTEE

DATA SHEET

PARALLEL BETWEEN POWER AND COMMUNICATION CIRCUITS

Power Circuit Data—1

Date of Survey ....

1. Parties to Parallel :
   - (*a*) Power Utility ....
   - (*b*) Communication Utility ....
2. Location of Parallel ....
3. Length of Parallel ....
4. Type and designation of Power Circuit ....
   (Wood poles, metal tower,
   number of circuits, etc.) ....
5. Configuration
   - (*a*) (1) Flat Horizontal / Vertical, (2) Equilateral, (3) Right Triangle, (4)
     Submit dimensioned sketch for other types.
   - (*b*) Groundwire : Diameter and Material. Include in sketch (*e*).

(c) Approximate distance between adjacent ground connections—feet .

(d) Diameter Power Conductor . Material

(e) Conductor Spacing and average height of same above ground. Submit dimensioned sketch.

(f) Crossarms Wood ? . . . . Metal ? . . . . Grounded .

6. Voltage between Conductors . . . . . K.V. Phase Cycles . . . .

None

7. Neutral Ground Single Location of Grounded Neutrals . . .

Multiple

(Cross out words which do not apply)

Resistance in Grounded neutral . . . . Ohms

7a. General Soil Conditions . . . .

8. Insulators, Type, etc. . . . . . . Grounded Pins or Hangers ?

9. Transpositions :

(1) What is the distance within which the line is completely transposed or revolved ? . . . .

(2) Is the direction of rotation of power wires in the same or opposite direction from that of telephone transposing ?

. . . .

10. Right of Way (whether mainly Public or Private). . . . .

11. (a) Submit sketch of electrical connections and simple route maps on separate sheet or back of this sheet.

(b) Show points of transposition in power circuits.

Show points of transposition in telephone circuits and their relation to transposition points in power circuit.

Show points at which power and telephone circuits cross.

Show average measured separation between centre lines of power and telephone lines and length of sections for which such averages apply.

12. Indicate frequency and magnitude of Tree Interference.

December 28, 1921.

Replies were received from 13 Companies. Of these 7 had no lines operating at 13,200 volts or over. The remaining 6 Companies cited 26 exposures in which transposition had been put in to prevent inductive interference.

In dealing with inductive interference problems it is suggested that the representatives to each party to the parallel make surveys, which should be drawn on Department of Militia and Defence Maps, Scale 1″ = 1 mile or 1″ = ½ Mile, with field notes kept in sheet form as shown below, and filed with the Maps.

(1) Date and name of surveyors, name of lines and direction in which survey is made (with or against transpositions in telephone lines).

(2) Pole numbers and pole heights of both companies.

(3) Separation of lines (horizontal).

(4) Number of wires on each pole and pin positions.

(5) Designation of circuits.

(6) Transposition systems.

(7) Configuration or sketches of construction showing abrupt changes in this configuration.

(8) Transpositions in power circuits. Give details of construction.

(9) Dimensions of cross arms, their separation on the pole and separation of wires (if there is a standard construction, the exact dimensions can be secured from the office records).

(10) River crossings, underground and aerial cable spans, giving their lengths.

(11) Loading coils.

(12) Cross overs of power and signal circuits with the angle of crossing.

(13) Separation of lines at points where one line leaves the other and angle of leaving.

(14) Pin position of street lighting circuits.

(15) Points where load or feeder branches connect with power line.

(16) Repeating coils.

(17) Switching stations in the power lines.

(18) Taps, etc. to telephone lines.

With information in regard to inductive exposures kept in such a manner it is a comparatively easy task to make an exposure chart from which the co-ordinated transposition scheme may be worked out. It is obvious that any additional field notes which may help to reconcile the pole locations of one type of circuit with regard to the pole location of the other type of circuit should be made.

Where noise tests are made they should extend over the entire telephone line, or over the entire telephone transposition section, and not over the part of the telephone transposition section which is involved in the parallel only, as if this is done, an unbalance of the wires may result in the telephone system due to phantom transposition.

We have embodied in this report part of the report of the Joint General Committee of the National Electric Light Association and the Bell Telephone System.

It is contemplated that the complete schedule embodying the application to particular cases and the division of costs will be presented at a later date for the consideration and criticism of the member Companies before legislative action is asked.

PART OF REPORT OF JOINT GENERAL COMMITTEE OF NATIONAL ELECTRIC LIGHT ASSOCIATION AND BELL TELEPHONE SYSTEM.

Your Sub-Committee has gone over the results of this work carefully and now presents this initial report outlining certain recommended principles and standards. These apply generally to future construction but may be employed as occasion requires in clearing up existing situations.

As an essential step in promoting conformity with these recommended standards and principles, an arrangement should be set up between the respective utilities providing for the interchange of pertinent data and information relative to proposed and existing construction and changes in operating conditions, which may be concerned in situations of proximity.

CLASSIFICATION OF SITUATIONS OF PROXIMITY

Existing standards acceptable to both utilities are available covering the situations arising out of crossings, conflicting construction and jointly occupied poles.

As to the question of parallel construction, standards acceptable to both utilities are not yet available but certain general principles of procedure have been agreed upon and a program is recommended with a view to the early development of mutually satisfactory standards.

CROSSINGS

The National Electrical Safety Code provides an acceptable guide to practice.

CONFLICTS

By "Conflicts" are meant situations where two separate pole lines parallel each other in close proximity under conditions more specifically defined in the National Electrical Safety Code.

The National Electrical Safety Code provides an acceptable guide to practice.

The Safety Code does not include the subject of inductive interference in its scope. As far as inductive co-ordination of circuits is concerned, the principles recommended below under "Parallel Construction Generally" may be considered as applying to "Conflicts" and "Jointly Occupied Poles."

JOINTLY OCCUPIED POLES

There are very substantial advantages to both utilities in the employment of jointly occupied poles where the conditions and character of the circuits permit. The joint use of poles by supply and signal circuits is generally preferable to separate lines when justified by considerations of safety, economy and convenience and presuming satisfactory agreement between the parties concerned as to terms and conditions.

The preferences and construction requirements of the National Electric Safety Code for joint use between supply and signal circuits are tentatively accepted. In order to reach a final understanding, particularly with regard to the question of joint use involving certain types of circuits, your Committee finds that further consideration is necessary.

PARALLEL CONSTRUCTION GENERALLY

The problem of inductive interference requires the combined consideration of both power and communication utilities because it arises from contrebuting characteristics of both systems and their physical relations. The situations encountered include parallel lines generally, whether on separati pole lines or on joint poles.

In approaching the solution of this problem, it is recognized that the public interest is paramount and that the power and communication utilities must be able to render service to the public in an economical and efficient manner, and that for this purpose both have been granted rights to use highways, and that they must utilize the highways to properly serve their customers with plants so laid out as to be readily accessible and easily operated and maintained.

The power utilities thoroughly recognizing the desirability of co-ordination state that as necessity requires and in order to serve their customers, they have the right and the duty to the public to place an electric light or power line of any type on a highway, provided the location and type of construction is such as to reasonably co-ordinate with similarly co-ordinated lines owned or operated by the communication utilities, and that they cannot be restricted from serving their customers in a reasonably economical and satisfactory manner because of the presence of communication circuits on the highways involved.

The communication utilities thoroughly recognizing the desirability of co-ordination state as their position that it is their right to have their service, when rendered over properly constructed lines, free from impairment caused by either (1) subsequently constructed parallel lines, or (2) existing supply lines by reason of subsequent changes in such lines or their operation, including in either case, as far as practicable, impairment caused by transient operating conditions on such supply lines. In cases of parallel constructon on highways such that impairment cannot be avoided at the proposed separation by available co-ordinative measures, the communication utilities believe they not only have the right but it is their duty to the telephone-using public to require that some plan, including separation adequate to prevent impairment, be employed.

While neither party hereto subscribes to the statement of position of the other party or relinquishes any of the rights claimed by it, the desire of both parties is to co-operate for the purpose of avoiding controversies which might arise out of their differences as to their relative rights, and we, therefore, recommend that they proceed along the following general plan, which plan it is confidently believed will enable both parties to meet their service requirements in a satisfactory manner, and at the same time leave unimpaired all of the rights claimed by either party.

RECOMMENDED PLAN FOR THE SOLUTION OF INDUCTIVE INTERFERENCE SITUATIONS.

I. GENERAL PRINCIPLES.

(a) Co-operative planning for all new construction.

(b) The location, construction and operation of all supply and signal circuits in conformity with generally co-ordinated methods, including precautionary measures which can reasonably be applied under generally prevailing conditions as distinguished from special situations.

(c) Where specific co-ordinative measures are necessary, those providing the best engineering solution should be applied. This involves -

1. Meeting service requirements of both systems.

2. The co-ordinative measures applied shall be selected without regard to whether they apply to one system or the other system or both.

3. The solution to be based as far as practicable on the state of the art at that time.

4. Measures of co-ordination wholly by separation should be considered with other measures of co-ordination where the former will not sacrifice economy and practicability and the convenience of rendering present and future service.

(d) Neither party should assume to be the judge of the service requirements of the other system, or of what constitutes good practice in that system.

(e) Existing cases to be cleared up in an orderly and systematic way as occasion requires in accordance with the above principles.

II. STANDARD OF CONSTRUCTION AND OPERATION IN ACCORD WITH THE FOREGOING PRINCIPLES.

(a) Adoption of more detailed principles as soon as possible for temporary use.

(b) Preparation by further co-operative work based on the existing state of the art of definite standards covering all classes of inductive exposures.

III. DEVELOPMENT WORK.

As soon as it can be done without interfering with the work recommended under II above, a co-operative study of the art shall be made in order to determine what practicable measures, if any, may be developed and adopted to lessen the contributing characteristics of both systems.

CONCLUSIONS

Your Sub-Committee believes that great progress has been made toward the solution of the problems arising out of the proximity of supply and signal circuits and to further promote the satisfactory working out of these situations recommends as follows:

1. That the Joint Committee, if they approve, adopt the principles and standards herein set forth and recommend them for general use by the respective utilities.
2. That special emphasis be given to the importance of working out problems of interference before definite plans are made for construction both with regard to immediate extensions and to general plans for future development.
3. That when differences do arise, every effort be made to arrive at a settlement through negotiations rather than resorting to court or commission proceedings.
4. That arrangements be made for proceeding with further co-operative studies along the lines indicated herein.

C. V. CHRISTIE
L. A. KENYON
A. I. PETERSON
J. H. TRIMINGHAM, *Chairman*

J. H. TRIMINGHAM:—When this Committee was formed, it was realized that it was necessary to have the co-operation of the Telephone interests; not alone because they were vitally interested in the subject, but because we cannot do anything in matters of this nature without co-operation. Further, the Board of Railway Commissioners for Canada unofficially informed us that they would appreciate some indication that co-operation was being practised. We therefore invited the Bell Telephone Company to appoint a representative on our Committee, and we have received a great deal of assistance from them.

We did not attempt to duplicate the work being done by the Joint Committee of the National Electric Light Association and the American Telephone and Telegraph Company, but confined ourselves to getting some idea of the scope of the problem in Canada. With this end in view, we sent out a questionnaire, which was pretty generally replied to.

I would particularly like to draw your attention to the telephone interference factor meter, which is now available to all Companies. This meter is made up in portable form, and consists of a series parallel arrangement of inductances and capacities having a direct current milliammeter shunted on a vacuum thermo couple, connected across the output side of the circuit, while the input side of the circuit is connected directly across a potential transformer placed in the circuit the wave form of which it is desired to determine.

The characteristics of the circuit between the instrument and the potential transformer are such as to make the current in the meter a measure of the telephone interference factor of the impressed wave, as specified by the American Institute of Electrical Engineers. The apparatus is much easier to operate than an oscillograph. It is very useful in showing the effects on wave form of various connections of transformer banks, etc.

I would like to introduce Mr. Canada, of the Headquarters Staff of the National Electric Light Association, who has been actively interested in inductive interference problems in various parts of the United States.

W. J. CANADA:—I think that I ought to be rather happy that the hour is growing so late, because I came up expecting to sit and listen and observe and get acquainted, rather than to speak. It is my first trip to Ottawa. I feel a little as though for Canada to come here is like bringing coals to Newcastle.

I would prefer to speak about general relations of our companies with other utilities rather than to confine myself to inductive interference in its technical aspects. Inductive interference being one of the relations which takes in several public utility groups, the National Electrical Safety Code another, and of course there is also the National Electrical Code which is almost unanimously accepted.

We are sometimes spoken of as an infant industry, and I presume that was very applicable as an expression ten years ago. But we are becoming rather grown up now. We are getting to the point where we can sit together with other groups of utilities and don't have to have the heartaches when parental authority is exercised by administrators, but can get right in and play the game, but, as Mr. Trimingham properly brings out, according to rules. We have found out that we must have machinery for playing the game, and that machinery is fully as important as establishing a theory.

As you may not fully understand how the N.E.L.A. is now trying to approach some of these questions, I might state that two years ago the N.E.L.A. was to some extent reorganized along lines to establish functional departments. One of these was for handling certain more or less engineering relations with other groups. Our group goes into engineering matters which are of general interest public questions, matters affecting the whole public, and is endeavoring through its Engineering Department to establish that continuity of effort which, as Mr. Trimingham so very well stated, must be brought into effect. We can get in touch with the various state activities, state bodies and organizations such as the C.E.A., and by that means can assist in attaining and maintaining better rules of the game than we had a while ago.

One of our difficulties in the United States and in Canada is the differences in requirements made on power lines and signal lines by different agencies. The earlier rules prepared when the subject was not as well understood as it is now were very incomplete; some were very severe, many of them were rather defective. We should not lose sight of the fact, in any argument on rules or discussion of them, that these former defective rules were the basis upon which many of our better present rules were started. They arose out of some degree of ignorance, and were realized to be defective measures after some experience in trial application.

The action of the American Engineering Standards Committee on the matter of wire crossing specifications, some time ago, was to call a

conference of all interests concerned in such rules, and to place before this Conference the question of whether we should have a National Electrical Safety Code, and should we have a National Crossing Specification, and if so what should be the relation between the two? At this Conference some fifty were in attendance, representatives of all rule administering bodies of the entire United States, many administrative jurisdictions from as far west as Minnesota being represented. Canada also sent its representative. There were also present all the different engineering bodies, and all the utility organizations such as the N.E.L.A., Bell interests, independent telephone associations, together with many Federal bodies interested in rules for electrical construction.

There was, after that meeting, a unanimous vote participated in by everybody present, including nine railroad representatives which gave unanimous approval to the National Electrical Safety Code as an American standard and suggested that a sectional committee be formed to discuss and consider any proposed revisions, and that this same sectional committee should also be directed to prepare crossing specifications to be in accord with the Safety Code.

On the matter of inductive interference we are in an earlier stage than with safety rules. We are at the stage where a few bodies at various places in the country have prepared rules. There was an effort made, following the California experiment at rule development and their great amount of experimentation and testing in interference matters, to get their particular set of rules adopted throughout the country. Certain groups of utilities other than ourselves made organized attempts to secure approval of this particular set in different parts of the country. This was done in a wrong spirit, partly of ignorant belief that a fair result could be so easily attained and partly with the idea of punitive action against our utilities. Fortunately, we have now got to the point where all the important interests are willing to drop this method of action and now the lighting companies, through such organization as yours and the National Association, have established sufficient unity of purpose, sufficient organization and sufficient ability and understanding of the situation so that we can really help in its solution and stand as participators in that solution. This is the happy state at which we have now arrived. We are aiming to formulate these rules of the game which we are playing entirely in the public interest for the fullest use of the public's property, such as highways, and for the most economical use of the money which is expended for public service, and which the public finally pays. Our whole purpose should be this, and every organization, as far as we are given representation therein will be urged to work with this same end in view.

We have so far prepared inductive co-ordination principles and are now proceeding to formulate inductive co-ordination practices. We are not yet calling these practices rules, because we cannot be sure which of them would properly be rules or which of them most properly would be called recommendations or useful information, so for the next stage we

are calling them practices and we are not certain which of them might be for general application and which for special application to particular cases only. That will develop as we are able to make progress in the formulation, analysis and trial of these recommended practices. Your continued co-operation will assure that Canadian experience and judgment will be fully taken advantage of in this very important work, and that the result shall be fair and creditable.

PRESIDENT:—Is there any further discussion on this subject?

With regard to the Inductive Interference Committee, I am not quite clear in my own mind of the report on this Committee. Mr. Lariviere, of the Public Service Commission, stated at the meeting that for lines constructed on any highway in order for any other line to be constructed permission would have to be applied for to the Commission, and such lines could only be constructed with their consent. I do not know whether our Committee took this up.

J. H. TRIMINGHAM:—The Inductive Interference Committee is, as I said before, waiting on the set of rules to be specifically made by the joint committee of the American Telephone and Telegraph Company and the N.E.L.A. It is hoped when that specific set of rules is made, to get legislative action in Canada. The reason why we think it is desirable to wait is because we will thereby get uniform legislation in Canada and the United States.

PRESIDENT:—This is very interesting. The Inductive Interference Committee might well ask the Legal Department as to what the new laws are in the Province of Quebec regarding jurisdiction of the Public Service Commission. Mr. Canada has given us such a very good description of the effort in the United States to get all of these different bodies together, and told us how this whole matter is slowly evolving through the different stages that all of these movements do. I am sure it has given us a good deal of pleasure to listen to him.

I presume that our procedure here will undoubtedly follow along similar lines. I hope we will be able to take advantage of the work that is being done, and possibly will not have to go through quite so many difficulties as they are experiencing in other countries. If we can do that we certainly will gain materially.

We have another report this afternoon, and if there is no further discussion I am going to ask Mr. Davies if he will present his report on Rural Line Extensions.

REPORT OF THE RURAL LINES COMMITTEE

The Committee has met regularly, and considered the various problems of rural line extension.

A questionnaire was issued to Member Companies and it was found that there was no similarity between the rates or procedure as to ownership of extensions or as to the practice in financing extensions; neither was there any similarity in the amount of electricity used by farming customers in different sections of the country, and finally, the farming customers as such are practically non-existent on the lines of the Public Utilities operating in Canada.

The Committee investigated the following matters, and reports progress as under.

DEFINITION OF RURAL EXTENSION

An attempt to define a rural connection has been made by the N.E.L.A. Committee, so far without arriving at any standard. It was thought that any extension outside of municipal limits, in which an operating Company has a franchise, might be considered as a rural extension; on the other hand, for tax evasion purposes it is frequently the case that a community will spring up just outside municipal limits and that the type of business to be served will be exactly the same as within the municipality. Such customers might be considered as urban customers, but there is always a point where business thins out and the customer of the rural class, *i.e.*, one requiring special investment, will appear. Again, such districts as a rule are not incorporated and do not contract for street lighting service and the revenue per pole is therefore reduced.

INVESTMENT BY COMPANIES IN RURAL LINES

It was thought that where the density of customers is more than 10 per mile, that Companies might possibly invest some money in the construction, but care must be taken to watch all the items on the debit side.

OWNERSHIP OF LINES

It seems essential that Companies should retain ownership of lines, The reasons are well set forth in the N.E.L.A. Committee's report, and are briefly that customers are not able to maintain lines properly and are liable to let them run down; secondly, they are not strong enough financially to take care of any liability, so that such liability might revert back on the Company; thirdly, they take up valuable right-of-way, and if such lines are at any time required to carry higher voltages or are changed to transmission lines, it is not easy to arrange the change.

PAYMENT OF LINE BY CONSUMER

Payments for lines are better made outright or 50% before starting the work and the balance on completion. It is very necessary to have a definite understanding as to what is to be paid, and a lump sum is preferable.

If the line is built for cost, the word "cost" should include a definitely stated overhead, otherwise it is difficult to establish such items as purchasing expenses, rents, etc., which are a legitimate charge against all material handled. Wherever possible, farm help should be used, and all material such as poles, obtained in kind this cuts down the amount of money which the farmer has to supply in cash.

When making contracts for building lines for customers, arrangements should be made to have the customer trim all trees on the extension.

PERMANENCY OF BUSINESS, EXPERIENCE OF RURAL TELEPHONES

There is already considerable experience, both in Canada and the United States, of cases where farming customers have discontinued their use of telephones in such numbers as to make it impossible to give service even at cost.

In a case in Ontario recently the rates were raised a very small amount, *i.e.*, from $15.00 to $18.00 per annum, and out of 2,200 telephones affected over 600 were taken out.

Farming districts often run down and the farmers move into town. There is no certainty that farms will be permanently occupied, the New England example being a case in point.

There are other classes of business in small communities which cannot be depended on. The sash and door factories are seldom permanent and grain grinding often drops off, business being entirely dependent upon the operations of the big milling companies who can reduce the price of feed and put the small grinding plants out of business. Quarries and brick yards are also very uncertain; several cases are known of quarry districts which have been fine revenue producers, which are idle to-day without much possibility of their ever re-opening. Mining is also precarious, and no money should be invested by companies to deliver services to mines. Small railroad division points are also subject to change and removal, and coaling points on railroads similarly change with a change in management or traffic density.

Great care should always be exercised in making extensions for business which may as time elapses disappear.

APPARATUS FOR USE ON FARMS AND K.W.H. TO BE EXPECTED

The following apparatus can be used on farms with the following approximate K.W.H. per month :—

Lighting	from 15 to 30 K.W.H.
Cooking	from 150 to 300 K.W.H.
Pumping	from 10 to 200 K.W.H.
Milking	from 100 to 200 K.W.H.
Silo-filling	100 K.W.H. per annum
Chaff cutting	30 K.W. Hrs. to 50 K.W. Hrs. per month
Refrigeration	150 to 200 K.W. Hrs. per month
Wood cutting	100 K.W.H. per annum

Fallacy of Selling Silo-filling and Threshing Outfit to Farmers

Silo-filling calls for a 7½ H.P. motor and the use is about two days per annum. Threshing calls for 10 H.P. with the use of two days per annum.

It is much better to let the farmer take care of this business with a gas engine.

Wood sawing is not at all a profitable load, requiring 5 H.P. motor at least and being used a few hours per annum.

Transformer Losses and High Maintenance Cost of Lines

Transformer losses on rural lines can easily exceed the K.W.H. usefully employed. The power factor also is very low on these lines and the resulting cost to the Company is much higher than for city service. The diversity also is very poor and generally a transformer is required for each customer. Assuming for the smallest class of customer that a 2½ K.V.A. transformer is used, the losses on this would be at least 30 watts; this taken over a whole year requires 263 K.W. hours.

Power factor on this energizing current is around 18% to 20%; when it is considered that, allowing for diversity, lighting consumers average only 100 watts a piece, it will be seen that the extra demand to take care of transformer losses represents 30% on the demand and 100% additional K.W. hours.

The maintenance cost of lines, meters, transformers, completely outside of the commercial cost of billing and collecting, assumes a figure approximating $100.00 per mile per annum, when the maintenance has reached a steady point.

The Committee feels that it is good policy to maintain reasonably good voltage in small rural communities, as otherwise the use of appliances is non-existent and the service not popular. Good voltage will increase the revenue obtained per customer.

A factor which cannot be neglected, is that of inductive interference. Companies are liable to create such conditions if rural lines are put up near telephone lines and the cost of straightening out the interference is considerable.

Rates, whether Special or Anchored, to Nearest Town Rate

It would seem advisable to use the rates in the nearest municipality and add a fixed charge to cover extra transformer losses, increased cost of billing and collecting, and extra maintenance costs. This fixed charge can not be less than $2.50 per month.

Meter Reading Methods, Bi-monthly, etc., Post-card Readings

It is reported that in outlying districts, several Companies are using post-card readings with satisfactory results.

Meter reading is an expensive business in rural communities. Various methods are being used to cut this cost; reading every two months is quite satisfactory and the meter reader should always collect at the same time. In some cases readings are being telephoned in by the farmers. A further scheme has been to sell customer a ticket good for $5.00 or $10.00 worth of electricity, and punch off the amount used from time to time.

THE COST OF COMPETITIVE SYSTEMS AND RUNNING COST PER K.W.H.

In presenting arguments to a farming customer as to why he should be glad to pay the cost of extending the service, it is well to bear in mind the fact that the cost of small isolated plants of limited capacity is very considerable; thus a well-known maker in Canada lists his machines at the following prices, F.O.B. Factory :—

300 Watts		$ 425 00
600 "		585 00
850 "		815.00
$1\frac{1}{4}$ K.W. Plants		925 00
$2\frac{1}{2}$ " "	without battery	1,400 00
$2\frac{1}{2}$ " "	with battery	2,500 00

These plants, up to $1\frac{1}{4}$ K.W. are for 32 volts, larger sizes 110 volts. The cost of installation, etc., will be a considerable amount and the cheapest plant will not cost much under $600.00 installed for 300 watts.

The running costs of these outfits are given as 9 cents per K.W.H. by the manufacturers, but this contemplates steady running, no repairs. When all things are taken into consideration and the fact appreciated that storage batteries are in the hands of unskilled people, it will be found that the cost will probably be nearer 30 cents per K.W.H. than 9 cents.

When it is considered that the Central Station rural line will have behind it plenty of capacity, no operating troubles, service on a tap at all times, and at an economical voltage for which standard appliances can be obtained at the lowest prices, there is every argument in favour of the farmer spending just as much money on a transmission line as he will put into a liability such as an isloated plant is.

Your Company believes that where it is impossible to connect up a farmer, from a point of view of the present cost, that the sale of an isolated equipment is a good policy. Once a farming customer has used electric service he will not be satisfied with anything else. Various cases are known where immediately Central Station service is available isolated plants are shut down, and a recent case is reported where six users of isolated plants clubbed together and paid the cost of the extension to meet the Central Station Company line.

CHEAPENING OF CONSTRUCTION, REFERENCE TO UNDERGROUND WORK IN ONTARIO

In order to bring more of the farming business into the economically possible class, it is very desirable that cheaper methods of construction of rural lines be developed. This is a problem for the Overhead Lines Committee to study.

One company is using single iron pins screwed into the pole in place of cross arms, which has resulted in a very considerable decrease in the cost of framing the poles.

The Ontario Hydro-Electric Commission is trying a new type of construction, viz. : the use of single conductor, rubber insulated, lead covered, 2,200-volt cable, laid directly in the ground about 18″ deep, plowed in.

The system in use is 4,000 volts, 3 phase, 4 wire, with a grounded neutral. The main trunk lines are composed of three single cables bonded together, using the lead as the fourth wire, and single phase taps are run with one cable, using the lead as a return. This construction is reported as being cheaper than pole lines; all transformers are mounted on poles and the cable run up the pole. These transformer poles act as junction poles, so that the average distance between exposed points on the underground cable is only 500 feet.

One hundred miles of this construction is going into operation this summer, and its operating performance will be a valuable study.

From the above, it will be noted that your Committee is making a report that is more or less a warning to Member Companies to very carefully consider rural business before going into it extensively. The main problem is to develop the uses of electricity, so that the farming customer can economically supplant other methods of obtaining present results by electrical methods, and in doing so, use at least $200.00 worth of electricity per annum without creating a heavy demand.

Wisconsin Farm-owned Lines Show a Deficit

An interesting and significant study of the losses in the rural distribution of electrical energy was presented at the recent meeting of the Wisconsin Utilities Association at Milwaukee. The data are for lines that are owned by the farmers and are significant because they are taken from the files of the Railroad Commission. Deficits running all the way from $18.00 to nearly $68.00 per consumer are shown. The figures are of particular interest to central-station men who must combat the farmers' idea that the central-station company is making a mint of money out of the service. Not only has the revenue not paid a return on the investment, but depreciation has not been covered in any of the cases, and in some of them the revenue has not covered the current operating expenses. The figures should be valuable to any central-station operator who must handle rural distribution business.

Cooking is one of the most desirable loads, and when new extensions are under consideration, if the farming customers can be induced to buy ranges, an extra $50.00 per annum at least can be expected. With the gradual depletion of wood around the farms, cooking will have to be done by some other methods, and electricity is more economical than oil or coal.

On an extension made last year in the States of 2¾ miles in length, thirty out of thirty-six customers took electric ranges, and as a result the average income per customer has worked out at $80.80, for 1760 K.W. hrs. This is a step in the right direction, and it is on these lines that the farming business can be looked forward to as good business instead of being otherwise.

Respectfully submitted:

R. J. Beaumont
G. M. Anderson.
R. J. Everest.
R. W. Barclay.
P. T. Davies, *Chairman.*

REPORT OF CANADIAN MEMBER OF THE RURAL LINES COMMITTEE OF THE N.E.L.A.

Your representative was unable to attend the first two meetings of the Committee held in Chicago in November and December, but had the pleasure of being present at the meeting in New York on January 27 and 28. He has, however, been in touch at all times with the N.E.L.A. Committee, and has been able to give the N.E.L.A. Committee the experience of our Canadian Companies in the problems of rural community service

The ground covered by the National Committee has been considerable, including the following:—

POSSIBILITIES FOR SERVICE.

A study shows that the untouched business in the States amounts to 6,000,000 farms out of approximately 25,000,000 homes, which will call for some $2,000,000,000 of investment for service. On the same basis are practically 500,000 farms in Canada to be reached, which would call for some $50,000,000 to $100,000,000 to be spent for transmission lines alone.

OWNERSHIP OF LINES

Two schools of thought, the most popular being (1) that the rural lines should belong to Companies and be maintained by them, (2) that these lines should belong to the customers but be maintained by the Companies at the cost of the customer.

FINANCING.

The general practice and the opinion of the Committee is that the lines should be provided entirely at the expense of the customer.

VALUE OF ELECTRICAL SERVICE TO FARMERS.

A considerable amount of work was done to find out the value of service already being supplied to farming customers, and it was found that farmers are willing to pay from $50.00 to $100.00 per annum for ordinary service. Where dairying is carried on, from $200.00 to $250.00 per annum is the present value of the service.

RATES.

The rates in the United States of course are regulated by commissions. These commissions have recognized the problem and are devising rate methods to cover the cost of service.

The general accepted form of rate is now a fixed charge, covering the extra cost of maintenance of the line and transformer losses, meter reading, etc., plus the prevailing rates obtainable in the adjacent municipality to which the service is physically attached. This rate is predicated on the supply of the whole cost of the extension by the farming customers.

FARM USES.

A special Committee has been appointed to study the adaptation of electrical apparatus to existing farm machinery, and to work with farm machinery manufacturers with a view to developing new apparatus more suitable for use of central station service.

COST OF MAINTENANCE ON FARM LINES.

The Committee developed an accounting system and also a technical data sheet, by which all the operating and financial statistics of isolated lines serving rural communities can be checked These forms have been supplied to various Companies, and it is the intention to obtain definite costs and operating data, so that the true cost of service and the actual return per K.W. and K.W.H. will be known.

Your Committee will be glad to furnish a set of these tables to any Member Company who is willing to segregate their costs and determine the operating characteristics of individual lines. The accounting features are drawn up to correspond with the N.E.L.A. practice, all that is required being sub-division and segregation of existing N.E.L.A. accounts and sub-accounts.

PUBLIC POLICY

The Committee is keeping in touch with various farm journals, with a view to editing all references to electricity on farms, when supplied by Central Station Company, it being very essential that proper information as to the cost of service should be presented to the farming community.

Generally, the whole problem of rural service to rural communities and farming customers is in a state of uncertainty; various methods have been tried often without the true cost of service being known. There is a tendency in the United States, as well as in Canada, to keep adding on customers to the end of the lines without any definite policy.

The National Committee will be able to accumulate facts as to cost of operation, and lay down a rate structure which will permit this business to be handled at a reasonable profit.

Respectfully submitted:

P. T. DAVIES.

Canadian Member of the N.E.L.A. Committee.

P. T. DAVIES:—We have all received copies of this report, and I am not going to try to even pick out spots on it.

The report is a negative one, that is to say, our Committee has come to the conclusion that the extension of rural lines must be proceeded with with the greatest caution. The factors of expense are not well known yet. Progress in the United States shows that the Public Service Commissions there, aided to a certain extent by the Public Utility Companies, were unable to set rates to approach even the cost of giving service. The Wisconsin Public Utility Commission is perhaps the most advanced of any in the United States in this regard. On the back of the report you will see a table clipped from the "Electrical World" quite recently, which shows result of the application of the rates of that Commission to rural line distribution in Wisconsin. The report shows that deficit on the line varies from 44 per cent. to 73 per cent. These deficits are all accumulated under rates set by the Wisconsin Commission. There are many things even there that are not defined. The matter of

DATA OF CERTAIN RURAL ELECTRIC LINES IN WISCONSIN OWNED BY THE FARMERS

Company	Average rate first K.W. Hr cents	Minimum monthly charge	Revenues, 1921.	Expenses, 1921	Amt. left for return and depreciation. 1921	Minimum depreciation requirement. 1921.	Minimum return, 1921.	Deficit, for 1921	Deficit per consumer. 1921.	Average consumption per consumer 1921.	Energy purchased 1921. K.W. Hr.	Energy sold. 1921. K.W. Hr.	Per cent loss.
*A	12	$2.00	$4,779.33	$4,774.12	$ 5.12	$1,633.41	$3,266.88	$1,895.20	$48.95	$46.00	$101,940	55,348	45.7
B	10	1.00	282.70	317.16	34.46	140.48	280.96	455.90	56.95	31.00	6,984	2,964	57.4
C	18	3.50	564.91	‡801.40	236.49	360.00	720.00	1,316.49	57.40	9.00	9,240	2,518	73.0
D	15	3.50	498.06	464.54	33.52	133.00	266.00	365.48	30.46	....	5,477	....	
E	†10.1	‖	2,681.54¶	2,348.18¶	333.36¶	653.31¶	1,306.69¶	1,626.64¶	27.11	41.00	30,701	17,182	44.0
F	13.2	3.50	922.65	796.21	126.44	140.00	280.00	293.56	21.00	....	10,938	....	....
G	14	2.00	85.18	151.92	66.74	156.46	312.93	262.29	37.60	....	¶¶1,340	....	....
H	30	....	1,507.07	1,381.89	125.18	368.00	736.00	978.82	36.50	43.5	49,400	14,140	71.6
I	13	......	....	....	....	70.00	140.00	**510.00	‡‡67.75	....	....	....	
J	9.8	††	1,638.81	1,195.31	443.50	461.00	922.00	939.50	24.60	21.6	22,260	9,856	56.0
K	11.2	1.50	1,129.09	1,264.99	135.90	261.00	522.00	918.90	23.60	22.6	36,804	10,600	71.0
L	......	....	941.06	1,167.78	226.72	140.92	281.84	649.48	23.20	....	7,941		
M	12	1.25	407.24	327.16	80.08	132.80	265.60	318.32	18.70	....	9,171	....	

*Company has grist mill on line which consumes about 1,000 K.W. hour annually. ‡Cost of energy plus meter reading, labor only. †Minus 1 cent discount. ‖ Rural charge, $1\frac{1}{2}$ K.V.A. transformer $2.50, 3 K.V.A. $3.50, effective last two months. ¶Seven months only. ¶¶Five months only. **Yearly requirement for minimum bill, depreciation and return. ‡‡Same as ** per consumer. ††Demand charge of $1.00 per month added.

distribution lines is always an open problem. Many utilities do not appreciate the fact, as we are all fairly new in this field, that there is an expense of $100 per mile per annum accumulating upon any distribution line. We cannot get away from it. You may put it off three or four years, but sooner or later, according to the records of the Company with which I am connected, which record is very carefully kept, it has to be faced, for the amount works out at $100 per mile per annum. This condition is often overlooked.

Then again there is expense of waste electric current on this line. Transformers have to be supplied to practically every customer. It is definitely established that the current used for energizing transformers will be something more than the current actually registered on the meters of the customers. We will supply 2 KWH for every one we are paid for.

I would like to bring in a report in which we could give hope of rural distribution providing a profit. I would be quite pleased to bring in a report showing us at least breaking even. At the present time we do not see that farmers in our section of the country can afford to give us enough money under the present application of economics, as we know them, to pay even the cost of the service. In our section of the country farmers are willing to pay $30 a year for light, and it might be brought up to $100 for cooking and pumping. But even this is absolutely inadequate upon any basis whatsoever, so far as we can make out.

The time will come, we hope, when the farm business will be so developed by the use of electricity that each customer will be a prospect for revenue of some $100 to $200 per annum. If they are then spread about 20 to the mile, it is possible we will be able to make some profit out of it, but so far we do feel we cannot bring in any report which would lead us to encourage any of our member companies to go into the matter of extending their lines haphazard for rural business. I would like to have brought in a better report, but as we see it we are unable to do so at the present time.

A. A. DION:—Will you allow me to break into the discussion? The Nominating Committee have instructed me to give a notice of motion which is necessary. They believe that they would like to have discussion to-morrow morning on the question of a change in Article 6, Section 1, of the Constitution, which provides for the officers of the Association. The Constitution provides for a President, 1st Vice-President, 2nd Vice-President, 3rd Vice-President and Secretary-Treasurer. They would like to have discussed the change to a President and three Vice-Presidents, instead of 1st, 2nd and 3rd Vice-Presidents, and it is a part of the Constitution that notice must be given at a previous sitting. I am giving notice now, and the matter will come up to-morrow morning.

PRESIDENT:—Gentlemen, we have heard Mr. Davies' report. He is in the midst of the stress of trying to solve this problem, and I know it is a very serious one for any company operating in the district where

we operate, in Quebec, but I must say that I personally do not feel quite pessimistic (but perhaps I should not say this, as I do not know why Mr. Davies feels pessimistic about it). I do not think it would be fair for us to have Mr. Davies' report go out as expressing the opinion of the Canadian Electrical Association regarding the future. It seems to me that we should emphasize a little stronger the early remarks of Mr. Davies.

At the present time we have not solved this problem, and that we hope it will be solved. We do not know how much these things shall count when the problem has to be solved and some solution reached. Demand for this service from thousands of homes in the country keeps pressing on all the utility companies, and we have got to recognize that not only is this one of the elements behind municipal and provincial ownership of utilities, but even in the case where one need not think of that phase of the situation, the pressure is great, and the pressure of the farmers and small communities is such that we have to keep working on this problem and in some way try to reach a solution.

Mr. Bucke, is there anything that you can say to us on this subject?

W. A. BUCKE:—Is occurred to me as the paper was being read, Mr. Chairman, that there was a possibility of interesting farmers in the use of electricity by encouraging them to install isolated plants. There are, as you are no doubt aware, thousands of such plants scattered throughout the West. I understand that certain power companies in the United States have pursued this plan and, as each group of farmers used sufficient current to warrant the expense, a transmission line was run out to them and the isolated plants were placed further afield. The results were, apparently, in certain cases quite satisfactory.

J. B. WOODYATT:—As I understand, Mr. Bucke, this is an effort to promote the farm business. There is no difficulty at the present time promoting the farm business. The trouble is the opposite way. There are certain heavy uses for power on the farm, but it is for a very limited period, and outside of that the uses of power on the farm are small, so that with any ordinary rate per KWH it is very difficult to pick up more than $30 or $40 from a farm. We have no difficulty at all in picking up that much and in persuading farmers to pay twice the City rates, but even though the farmer pays $60 a year for service, and though we can find half a dozen to the mile, or something of that kind, we cannot find ways of making the line pay us. Our problem is not to persuade them of the advantage of the service, but to find some way of getting enough revenue to pay for the building of the line and the extraordinary maintenance costs per customer on account of the scattered distribution.

P. T. DAVIES:—In making this report, the Committee does stress the question of proper investigation. We do hope, of course, that we are going to get aid in this some time. It is a big business, and there is as wide a use on the farm as we have in our other communities. It is a big market in every direction, and we will have to cover it some time. The only way we will be able to do so will be by help from the farmers.

The Province of Ontario is going to pay 50 per cent. of the cost of these lines. I don't think that will be enough myself, but at that they are getting something.

The thing to stress at the present time is the operating costs of the lines, so that extensions will not be made carelessly. Our idea is not that the business is impossible or impracticable, but that those executives who have the matter of farm extensions coming to them should pay particular attention to the items of cost before establishing a practice which would be difficult to change later.

MR. WILSON:—Last year we extended our lines to five different small communities, a total of 11 miles, from our present rural lines and villages, and figured out that they had to pay the total cost to start with. They were to get refund of 25 per cent. of the revenue over and above a certain amount, to be returned to them each year. The majority of the money was advanced by rural banks throughout the district at 5 per cent.

W. H. WINTER:—It might be of interest just to narrate a few experiences of the Bell Telephone Company. Our difficulty has been that some years ago we got bonus lines from certain farmers. We thought we were doing a good job, and gave low rates. Now, we are in a position where we cannot discontinue the service, but have to spend thousands of dollars to replace poles, with the result that we are going to be put out of pocket if we continue to supply the service, so that is one point. It seems to me, speaking about rural extensions, what you have to think of is what will happen two or three years hence, when reconstruction is necessary.

W. J. CANADA:—Although it is getting so late, the remarks just made move me to say a few words regarding a recent storm in Wisconsin. There were scores of the smaller telephone companies who immediately filed pleas with the Commission to permit them to go out of existence, because they could not begin to rebuild their lines because the interest originally established with the farmers when the service was first proposed could not be duplicated.

PRESIDENT:—The problem is an extremly difficult one, and different companies must look at it differently. The Company operating in a district largely rural is going to look at it in a different light to a Company operating in an urban district. The general feeling, of course, I think, amongst all managers of companies is, that the Company must go as far as possible towards meeting these demands, and there are, and will be, cases where it is practically impossible to figure a profit, or even to break even, on every extension they are going to make, and all you can do is hope that some time in the near future business will develop and allow you to break even. If these extensions are a small percentage of your business and it can stand it, you can afford to make them for the sake of keeping the public satisfied with the Company that they are getting service from. I imagine that the Telephone Company is in a very much similar condition. They must extend their lines and

spend money, even at a loss, to provide service, in order to avoid criticism of the farmer, who seems to have such an important voice in our legislatures. The result is, they have to arrange matters in some fashion or other by taking it out of the poor city dweller.

Any further discussion, gentlemen?

MR. WILSON:—We have quite a little of this rural lighting and power distribution, about 45 miles. We have been in it about ten years, and at that time we figured out that we must have at least ten customers to the mile to provide sufficient funds or earnings to provide renewals and distributions. From the start off we had the customers to pay full cost of the service from the primary lines, and the further we go in the work the greater has been our astonishment at the willingness of the farmer to pay. We have had some extensions miles long paid for by the farmers. We have had no difficulty in collections after we have made survey and estimated the cost of the work, receiving cheques in advance of the work being done. We have been surprised at the willingness of the customer to pay. We put them on a minimum per month, running from $1.50 to $2.50, depending on the size and the number of his buildings to be served, and also for his pump and his milking set, and for his little motor for chopping. We have been fairly successful, but I don't know what would happen if we came against a really heavy loss through a storm, or something of that kind, although we are fortunate in the district which we are serving.

L. W. PRATT:—In the vicinity of Hamilton we have a growing desire on the part of the farming community to obtain electric service, due, I think, in large measure, to the action of the Government in subsidizing the lines served by the Hydro Electric Commission. We feel it is incumbent upon us in order to retain the good will of the surrounding communities to serve these customers. We do not expect to make much money. We feel that the profitable business will have to carry its share of the unprofitable, and the restrictions that we place on the business keep it down to reasonable limits. We require the customer to pay for the extension, but we retain ownership of the line. We also require the customer paying for the extension to permit us, without expense on our part, to connect any customers who may come along later. This seems a little unreasonable, but if you will give the matter thought you will come to the conclusion that it cannot be done in any other way. The rates we give are practically the same as our City rates.

I do not see any solution at the present time as to the problem of making the rural lines pay, other than that we must take the unprofitable with the profitable in the hope that in the future the problem will work itself out.

PRESIDENT:—Gentlemen, the time passes rapidly. It is half past five now, and we have this party on to-night. Have we further business or discussion on these subjects?

I want to remind you of the meeting of the Executive Session of representative of Classes A and D Members at 9.30 tomorrow. We want

to hold that meeting sharply on time, so that anyone who desires to get away by the noon train leaving here will be able to get back home.

Mr. Vinet, have you any remarks to make?

SECRETARY:—I have the railway certificates in my pocket, in case any of you wish to have them so that you can get the reduced rate. We will not receive the half fare return, because we did not come up to the required number. There were only 150, and a good many have come on commercial tickets. There will be a reduction of four-fifths, but not half as we hoped for. I have all the certificates here.

Dinner Dance will be held at the Homestead Inn, on the Aylmer Road. Special cars will leave the sub-way at 6.30, the dinner is at 7, and I would request that everyone be there on time, because the cars will be there promptly.

PRESIDENT:—Have we any further discussion? We have been rushing this along, but I don't want to hurry it, and we have got a few minutes left.

DINNER AT THE HOMESTEAD INN, HULL, QUE., FRIDAY, JUNE 16.

W. H. ONKEN, JR.:—Ladies and gentlemen, I am sure that Mr. Smith (not Julian C. Smith, but Mr. F. W. Smith) had no idea this banquet was going to be held in the City of Hull, as I know he would not have missed it. However, being in Los Angeles, he found it would be impossible to get here, so he telegraphed to Mr. R. F. Pack, at Minneapolis, at one time stationed in Toronto, who is now Fourth Vice-President of the N.E.L.A., asking him to come here and take his place, but unfortunately Mr. Pack was leaving for Europe, so it fell to my luck to deliver the talk for him. Of course I am always pleased, more than pleased, to come to the meetings of the Canadian Electrical Association.

I feel very much now as I did some years ago in a hospital in New York City. This hospital was very jealous of its reputation, so rather than have any of the patients die, they made sure before any surgical operation was to be performed that the best surgeon they could procure would pass on the subject first. So as I sat outside and waited, I found people coming out in blue garments and yellow garments, and some coming out with a ticket, on which was written "G.O.K." I asked an attendant what was the meaning of this. "Well, those who come out with the blue garments indicate that they have to be operated on for appendicitis. Those with yellow garments have to be operated on for tonsilitis." "Yes, but how about those others with the ticket?" "Well, the surgeons are in a quandary about those, and do not know. The significance of the ticket, G.O.K., is God only knows."

So why I should be sent here to deliver this message, it is a case of "God only knows."

ADDRESS OF FRANK W. SMITH, PRESIDENT OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Ladies and Gentlemen:

In extending to the Canadian Electrical Association the greetings and well-wishes of the National Electric Light Association, may I at the same time give expression to my sense of obligation to the bearer of this message, Mr. William H. Onken, jun., editor of the "Electrical World," who has accompanied me and Mr. Aylesworth in our journey to the Pacific and to the North-West, and who graciously consented to curtail his trip in order that he might be present at your Convention in Ottawa and deliver a message which I would have liked to have delivered in person, did not important matters make that impossible.

It is somewhat difficult for me to address Canadians on matters affecting the electrical industry in the Dominion, because I feel that such questions should be decided by Canadians themselves, without let or hindrance from Americans. You have shown yourselves quite competent to handle your own affairs and to safeguard your own interests, and it would ill-become me, granting that I should so far forget myself as to presume on your indulgence, to attempt to advise you on matters in which your knowledge is more intimate and your skill greater than mine. I trust, therefore, that what I have to say to you as President-Elect of the National Electric Light Association will be accepted in the spirit in which it is said,—a spirit of helpfulness, a desire to assist and to contribute out of our storehouse of experience towards the solution of your electrical problems.

I am very glad to have the opportunity of saying a word to the Convention on behalf of the National Electric Light Association. Great good and lasting benefit to the industry must come as the result of meetings such as those in which you are now engaged, where the problems that immediately confront the industry are presented and considered. There is no progress by mere existence. The development of the race is by connection and contact with our fellows. The wider the human contact the greater the human progress.

We in the United States have become more conversant with conditions in certain of the Provinces of Canada as the result of our investigation into the activities of the Hydro-Electric Power Commission of Ontario.

The system of the Hydro-Electric Power Commission of Ontario has been repeatedly cited not only in the United States but in Europe as well, as the most successful example of Government ownership and operation in the western hemisphere. There has never been any doubt in the minds of persons conversant with the facts that the service rendered by the electric public utilities in the United States and in the Province of Quebec under private management and under proper regulation is better, more dependable and less expensive than service rendered

by municipally-owned or state-owned electric public utilities. I say this advisedly because in the United States 95 per cent. of all of the electricity consumed is generated in stations owned and operated by private corporations.

During the wonderful development of the electric light and power business in the last two decades, municipal plants have been left hopelessly in the rear. While their number is large, their average size is small and judging from their performance one cannot escape the conclusion that they stand in the way of the consolidation of distributing systems and the concentration of energy production, or in other words, fling themselves athwart a path of economy and progress. If we in the United States had to depend on municipally owned plants for our supply of electrical energy, our situation would not be very different from that existing in London, England, where seven and a half million people are served from sixty-one separate generating systems with almost as many varieties of frequency and voltage, and where, as the result, the cost of producing electricity at the switchboard is greater than the selling price including profits in most of the large cities in Canada or the United States to-day. In fact, the total consumption of electricity by the seven millions of people in London, England, is less than the energy consumption of the few million people contiguous to and within the corporate limits of the City of Montreal.

The National Electric Light Association had, as you know, an exhaustive investigation made of the Hydro-Electric Power Commission of Ontario by two engineers whose training and experience are such as to render them free from bias towards state-owned enterprises, In fact, the engineers were very conversant with conditions in Ontario, having acted at one time as consultants for the Province in electrical matters. The report of Messrs. Murray and Flood on the Hydro-Electric Power Commission has been published and distributed to the membership. It forms a rather voluminous and impressive exhibit. In substance it is a wonderful tribute to the soundness of the electric light and power business as conducted in the United States and Canada under private ownership and management.

It is not a matter of opinion, it is a matter of fact, that Canada as well as the United States is greatly indebted to the electrical industry and more particularly to private capital for the development of one of its greatest assets—water power. Considering all the advantages which have ensued from such development, it seems hardly believable that the public will ever be unmindful of the great service which has been rendered by the privately owned electric public utilities or that it would be forgetful of the fact that the real interests of the electric public utilities and of their patrons, the public, are identical.

Next to the railroads and in certain sections of the United States above the railroads, the electrical industry has contributed more to the upbuilding of the country than any enterprise ever undertaken by private capital. We must not be content with the knowledge of this

fact however, otherwise we shall find ourselves in the same plight as the railroads. They too have contributed immensely towards the upbuilding of the country and yet witness their fate at the hands of the non-thinking public. In the United States we have a railroad valuation in the share and bond markets of less than $25,000 a mile for our 250,000 miles of railroad. To-day heavy taxes are being levied on these railroads and non-taxable bonds are being issued to put a surface upon public motor highways at a cost of $40,000 a mile for surfacing 18 feet wide. Is there any justice or righteousness in such treatment or does it offer an incentive for free people to expand and build? Is it right to tax railroads and then issue tax-free bonds for motor roads to assist still further in the destruction of the life arteries of commerce? By the same token, how can one acquiesce in public regulation of rates and service if the State itself is to engage in the same service in competition with existing utilities.

The electrical development of the Dominion of Canada has been along hydro-electric lines almost exclusively. In the United States we have worked long and laboriously for necessary legislation which would enable us to harness the latent powers of our water courses and develop them for the use and comfort of mankind. Within the year, after the enactment of the legislation, three hundred applications were filed with the Federal Power Commission involving a total of nineteen million horse-power. The growth in hydro-electric development in Canada, while not so spectacular, considering the population of the Country, is proportionately as great. The public has a right to insist that these water powers which are capable of development shall be utilized and that every effort should be made to conserve fuel through the transmission and utilization of hydro-electrical energy. The electrical industry under private ownership and management and under public regulation is eminently fitted to carry on this work and is willing to accept the responsibility. It seeks not unreasonably the active co-operation and assistance of the public and governmental authorities, for without it it would be foolhardy to engage in such pioneer work. It is a pleasure for us in the United States to know that the Dominion Water Power Branch of the Interior Department has taken a very broad-minded and far-sighted view of hydro-electrical development which is of great encouragement to private enterprise.

Future development of the electrical resources of Canada as well as the United States however is dependent upon favourable public opinion and proper public relations. With billions of dollars to be raised within the next few years to meet the demands of expansion of service, we need and must have the whole-hearted confidence and support of the public. People with money to invest are not attracted to a business or property towards which the public is antagonistic. Public opinion will do more than anything else to bring about that improvement in condition which is so needful for the proper financing of private enterprise. I am sanguine that once we can get before the public the

basic facts of our business, its principles and practices, they will endeavor to do the wise thing and they are very apt to do the direct and very wholesome thing. The problem is how to reach the public so that it may be correctly informed and that public opinion thus enlightened may move in the direction of national well-being. When I speak of the public I mean the average man, the man in the street who is accustomed to deal in easy and familiar terms. Unless the facts are presented to him in that form which attracts his attention and which he can readily grasp and understand without serious mental effort on his part, our attempts to inform him will fail.

Next to doing the right thing, the most important thing is to let people know you are doing the right thing. This is particularly true of businesses like ours. We must get close to the people in man-to-man fashion and endeavor to change the conception of the public towards corporations. They must learn from actual experience that a corporation is not that vague, indefinable thing but that it is a human organization, possessing all the faculties and attributes that human ingenuity and thought can impart to it. If we can change the public impression of corporations in this regard we shall find an entirely different feeling being manifested towards the electric public utilities.

One easy way to accomplish this result is to humanize our own organizations so that the public will see the corporation through the action of its employees.

The problems of finance are now uppermost and probably will continue uppermost in the electric public utility business for many years to come. It is essential that in the interest of the public welfare, electric public utilities be given rates adequate to establish their credit and to permit them to obtain sufficient equipment to handle present and prospective business properly.

There exists an erroneous notion that there are tremendous profits in the electric business. As a matter of fact we too well know that there are no profits at all. United States Government statistics show that 85 per cent. of the electric public utilities at the last census paid no dividends at all during 1917. All that the capitalist can hope to get out of his investment in electric light and power securities is a very limited rate of interest on the money loaned. Any money earned over and above that must be returned to the public in reduced rates, but unfortunately the tariffs in very many communities are so low that the return is only sufficient to protect the bond-holder and to leave very little for the stock-holder. In the electric public utility business we must pay wages to capital as well as to labour and it is essential to the stability of the enterprise that the wages of capital and labour be paid regularly and fully, otherwise we would have no operators. This applies equally to privately-owned and municipally-owned utilities. Capital is no respecter of persons. Every householder and farmer knows that if he expects to keep his home or farm he must earn enough to pay the interest on his mortgage and the same is true in the public

utility business. It is just as unreasonable to expect efficient and dependable service from an electric public utility labouring under the disadvantage of inadequate rates as it is to expect to get much work out of a starved and maimed horse.

In the opinion of the National Electric Light Association great impetus would be given hydro electric development if there could be inspired complete confidence in the theory that hydro-electric development is to be made by private capital subject to regulation and with only reasonable governmental supervision. We are engaged in one of the most progressive of industries, one that for many years to come must continually grow, one that has attracted engineering and executive talent of a high order and one in which the conservative investors of the country are steadily gaining confidence. We firmly believe that under private initiative and with private capital the latent water powers of the Dominion of Canada and of the United States can be brought to the service of man in the most efficient and economical manner.

We also believe that in the interests of economy and dependable service there should be wider and wider inter-connection of contiguous generating systems. We point with pride to the many great interconnecting systems now existing in the United States and commend the practice to Canadian electric public utilities. The largest inter-connected network in Canada is that of the Hydro-Electric Power Commission of Ontario and thre are other large inter-connected systems in and around Montreal. Further investigation will show that the advantages of inter-connection are such as to warrant its wider adoption.

Another feature of operation in the United States which we commend to the privately owned utilities of Canada is that of real public partnership, not political ownership. In the United States it is becoming generally recognized by company officials and the public as well that it is a most helpful thing for the millions of utility customers to become their own partners in public service enterprises through investment. This movement, started years ago on the Pacific coast, still continues to grow in popularity and strength so that to-day there are in the United States more than 1,600,000 holders of electric light and power securities. This home ownership of public service properties by reason of the wide distribution of public utilities has tended to bring about a more sympathetic understanding between the public served and the utility rendering such service.

With the better understanding incident to the establishment of predominant customer ownership in every community, we have every reason for optimism in facing the problems immediately confronting us.

With the return of prosperity the electric public utilities will experience more and greater demands for service. To prepare ourselves to handle the service requires an expenditure throughout the United States and Canada of approximately eight hundred millions of dollars a year for the next five years. It would be a calamity for the electric public utilities to fail industry at a time when it needed electric service

most, but with the growth of public friendship and well-deserved confidence it is safe to predict that neither in Canada or the United States will the public be lacking in that adequate and efficient service which is so essential to progress, comfort and welfare and which it has been the good-fortune of privately-owned utilities to mete out for so many years.

With this growing expansion and inter-connection will also come, as come it must, wider extension of electric service into rural communities. Farm life at best is one of drudgery. Nothing is more welcome to the farmers or contributes so much towards breaking the monotony of their lives as electric service. To the farmer's wife especially does this service appeal. Her opportunities for contact with the world are few, and yet unless she is contented and happy in her isolation, and relieved of some of the hardships of rural life, agriculture will be crippled; for on the measure of her ability to feed and look after the children and the help, depends the success or failure of the farm. These women are the salt of the earth. They toil unceasingly and uncomplainingly and it is for us of the electrical industry to gild their labour with the hope of new comfort and ease for themselves and their children. The strength of Canada as well as the strength of the United States depends upon agriculture.

There is no service possessing the power to transform rural life like electricity, nothing that appeals more to the imagination, that can be so easily and so universally applied, and nothing, considering all its advantages, which is attainable at so small a price. The opportunity and the obligation, gentlemen, is ours and if we possess the enterprise and spirit of the pioneers of our industry, that service, where it is economically possible to render it, will not long be withheld.

Private enterprise under the guiding genius of man has given the country its railroads, its telegraph and communication systems; private enterprise has developed a commonwealth yielding annually food products worth billions; private enterprise has wrestled with nature, harnessed her rushing streams, watered her furrows and true to the precept that "whatsoever a man soweth that shall he reap" has labored hard and achieved much. Private enterprise and private enterprise alone has created a powerful state and empire. Its eye is not dim nor is its natural force abated, and to private enterprise the world still looks for leadership and accomplishment. Let us continue bravely and resolutely to carry on.

LAWRENCE W. DAVIS, SPECIAL REPRESENTATIVE OF THE NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS.

Mr. President, members of the Canadian Electrical Association, ladies and guests, no invitation that I have received in the past three years has given greater satisfaction to the Executives of the National Association of Electrical Contractors and Dealers, which I represent, nor more pleasure to myself, than this opportunity of addressing the

parent branch of the electrical industry here in Canada, for I feel that it is a splendid opportunity for you to get into closer contact with the problems which are very vital to the retail industry, and that directly affect your business.

I am not here to suggest that there is not that friendly contact. The very fact that we are able to study the problem together has been a great advance in the industry. In the past three years I have had a wonderful opportunity to make a study of the retail distribution of your electric service throughout over 350 cities in Canada and the United States. Our National Association has several hundred members in Canada, stretched from coast to coast, and the problems which you have here are identical with the problems in British Columbia, and identical with the problems in other parts of the United States.

During the dinner Mr. Davies said to me: "Are electrical contractors of the United States making money?" and I had to answer, as I think I would have to answer in almost any locality: "Not as a group." That is not a satisfactory condition for any business that expects to attract to itself capital, or the best of man power.

It is an indictment against the industry which is deserving of careful consideration of business men. I believe that the power companies in the past have naturally turned their attention to the big and more spectacular problems of development of great power units, and the securing of large blocks of industrial and commercial power load, but to-day I am satisfied that, instead of ignoring this essential retail problem, you should turn your attention to it as an active part of your duty and of your business, that is, the distribution through the retailer-contractor.

I selected as my title (for every speaker needs a subject) "The Retail Distribution of Electrical Service," but I do not mean by that retailing in the sense alone of merchandising through stores. Our retailing goes further back than that. We know in the electrical business that nothing which the manufacturers make can be sold independently of the lines that stretch from the consumer to the power source, and no power unit that you produce can be delivered without its being delivered over wires.

That being the case, we as contractor-dealers occupy the position of direct contact between you and the public, and to-day I believe that there is a need for very careful study as to the manner in which that contact is being made, because it is far from satisfactory. Whether that trouble lies alone within the ranks of the contractor-dealer, or whether it is not a development of many things over which he is not responsible, and with which he is unable to cope, is a question to which I want you to give careful consideration. I do not expect to bring you the solution. No one man can. No one man is ever going to come forward to bring a solution to the problem, but I do hope to possibly present to you a group of things which will unlock the doors, and suggest that

you try them in your communities, and in the use of them open new opportunities for two things, additional load on your lines, and a far greater co-operation from the public, who are the mainstay of your success as public utilities.

No one group of the industry has a greater problem than the electrical contractor, and I say that with all due consideration. The manufacturer of electrical materials has capital sufficient to call in experts, accountants, efficiency experts; and as he is producing a product which is not going to vary in its character excepting slowly from time to time, the cost of it is not going to vary excepting as the labour costs and costs of material change, and he is able to arrive at a profitable selling price for his product when it is put on the market. The jobber knows what he is going to pay actually for his goods, and what it will cost him to do business, and he places a fixed price on a fixed commodity. But the electrical contractor, without capital to employ experts and accountants, and without proper training to handle such a problem, has the greatest and most difficult problem of all in that his product is every time a new variable. No two jobs for him are alike. He has got to keep in mind the correct quantity and quality of material he is going to use. Having selected the quantities and qualities of materials, he has got to employ labour, a factor which in itself is an example of the unknown quantity, because often he does not know even from experience in the past what the character of labour is going to be on each particular job; and then he has got to supply the one thing which he lacks, and that is training as a business man, to know how to apply the overhead costs of operation of business, and arrive at a proper selling price.

It is a big problem, and it is your problem (I say your problem, because I believe that the public utilities of the country are beginning to recognize this).

We have got to give attention to the wiring installation before we talk about merchandising, because there is no sense in striving to develop stores to merchandise appliances, and current consuming devices, unless the means of using them have been given to the public, and the one thing we lack all over the country to-day is the opportunity given to the public to use the electrical service which we stand ready to render.

The electric dealer has failed because of many things, principally. I think, ruinous competition in the contracting field. Now we are considering developing systems and schemes, co-operative leagues, electrical homes, co-operative advertising, selling campaigns, education of the public, etc., to sell the idea of the convenience of the use of electricity in the home and I want to say right here, that we are facing a problem of this kind for nothing, unless we get back a bit and solve some of the causes for the failure of doing this job in the past.

I often hear, I have heard it in this city, and in every city of Canada, the statement that conditions in this city are different. There

are a large number of new men in the field, economic conditions have placed men out of jobs and they have become contractors. Loose credit has made it possible for them to go into the wiring business. For instance, last year one Western city had 162 contractors. This January they had 498. And that is not the whole story. To be a contractor in that city you deposit $50, then when you fail you can go and draw out your $50. For every week of last year an average of 17 men put up $50 and 11 pulled it down. 11 men failed, and in the measure of those failures, failures going on in this retail distribution, is the big serious problem we are facing.

What is the trouble? I think the big trouble has been, they have not had co-operative education, assistance, guidance and training. They have not had opportunity to work under conditions that will draw into the business a better grade of men. The man should come in trained as a business man and not trained simply as technical wireman. We need to pause and study reasons why you are not getting a better class of men who will give you this service. I believe until you do, you will be unable to get from the public full understanding of what you are trying to give in electrical service. Without this you are not going to get public support in the full measure you are looking for.

How may these things be overcome? We feel that organization is one necessary step. There are two sides to this thing, one is the present and one is the future, and by the future I don't think we can measure it in three or four years. We have got to go at least five years ahead before we can see any definite change in the character of men. We can work with this present group of men, and through organization, education, co-operative assistance and study of the problems, we can continuously improve them. That is being done. I am hoping to see the retail groups and contractor dealers throughout Canada get together for the purpose of studying the problems to-day. I hope this will receive support and attention, and a good deal of effort by every public utility official, because without it it can only be partially successful.

There is another need and that is a greater spread, a greater opportunity for making a profit than exists to-day in the discount on practically all appliances handled by the electrical dealer. I believe that if the central stations would have their efficiency experts go into this, they could bring about a quicker study on the part of the manufacturers, and the solution of the problem. It has got to come. As it is there is no opportunity to make money, and if that is the case how can you expect to bring capital and brains into the retail end of the business? and without it you cannot get the backing of the public, which is essential.

I want to go further than that. I want to suggest that we make provision, not for this year alone, or next year, but five years from now. I believe that we can, through a system of careful watchfulness of the character of the men who now come into the business, encouragement of

men in your employ to study the retail industry, and perhaps under your guidance and direction go into training as business men, to give us a better class of retailers. I believe you can assist in organizing and educating such groups of men. I would like to see established throughout the country, in the trade schools, high schools and colleges, courses which would cover two, three or four years, to develop men who will bring better training into this retail industry. I believe that can be done. I think the first year should be given up to the technical side of the game. At the end of one year of technical work, it is up to the young man to determine which direction he wants to go, as contractor or dealer. If as contractor he should have courses providing for estimating or the technical end of the business, and then business study, including accounting, business management, financing, financial relations, study of overhead, turnover, buying, selling, management, If he wants to become a dealer, have a course that includes management, advertising, salesmanship, and with it again a study of accounting and financial relations. What will be the result? We can graduate in four or five years an entirely new character of man that we can bring into this game as your representative, because every retail contractor is a distinct and definite agent of your power companies. If you are careful in the selection of your employees in your companies, I believe you should have just as much interest and pay just as much attention to the character of men who are entering of their own volition, because they are your agents, and the public in large measure obtains its impression of the character and service they can get from the electrical industry as a whole from these men.

All I hope to-day is to leave in your minds a desire to study this question of the contractor dealer problems in your community, and in any measure you find it possible to co-operate in developing these men, I believe you are laying a foundation for the best possible good will and relationship with your consumers. (Applause)

H. A. LANE, DIRECTOR OF THE JOINT COMMITTEE FOR BUSINESS DEVELOPMENT OF THE NATIONAL ELECTRIC ASSOCIATION.

Mr. President, ladies and gentlemen, I am just reminded of the fact that I have not been assigned any subject, so how can I talk? The best thing that I can do is to tell you one little bit of a story. Really, this story is one that I am indebted to my neighbor for, and it is regarding a fellow who was going to give a talk. He felt very backward, but finally consented. He went through many arduous hours preparing the subject. After he had done so he got up on to the platform. Step by step he worked through his speech. The people began to drift out, however, until finally there was just one person left in the front row. When he had finished this long talk, he turned to the man in the front row, and said: "I am certainly much obliged to you for the extreme interest you have taken in my talk," then he turned to the chairman

and said: "I am very much indebted to you for the opportunity of addressing this most wonderful assembly." Just as he stepped down off the platform, he asked: "Pardon me, sir, but would you mind telling me just what it was in my talk that interested you so much?" "Oh nothing," was the answer, "you see I am the next speaker."

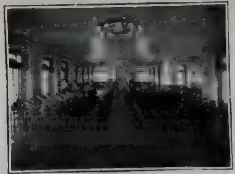
We have one more speaker left on the programme, and he is a mighty good speaker too, so I am just going to proceed with my address which is: "29 West 39th Street, New York City." (Applause)

Before the delegates and guests left the tables to enjoy dancing after a splendid dinner served on the Quebec side of the Ottawa River, Mr. George Leacock gave a most entertaining description, of course in his usual unsurpassed after-dinner speech style, of his first experience in real aviation.

Our good friend, Mr. Coffey, who so painstakingly kept the verbal records of the proceedings, found it impossible to take down Mr. Leacocks's speech, frequently drowned by his appreciative audience in spasms of laughter.

Hence just a mention of his contribution to the success of the social part of the Convention, and a hint to the members to attend them in the future.

Hotel Mount Royal, Montreal,
where the C. E. A. Convention was held



Hotel Mount Royal, Montreal,
where the C. E. A. Convention was held

33rd Annual Convention Canadian Electrical Association
Montreal, P. Q. June 21, 22-23rd 1923

PROCEEDINGS OF

ANNUAL CONVENTION

33rd Year

Canadian Electrical Association

HELD AT MONTREAL, P.Q.

JUNE 21, 22 and 23, 1923

Office of the Association

ROOM 301 POWER BUILDING

MONTREAL, QUE.

WE respectfully suggest that our members take SPECIAL NOTICE of the advertisements distributed amongst the papers and discussions, and bear them in mind when in need of materials.

CANADIAN ELECTRICAL ASSOCIATION

INCORPORATED

EXECUTIVE COMMITTEE 1923-24

President:

P. T. Davies
Southern Canada Power Co., Ltd, Coristine Bldg., Montreal, Que

Vice President:

R. J. Beaumont
The Shawinigan Water & Power Co., Montreal, Que

W. Paxton Little
Canadian Niagara Power Co., Niagara Falls, Ont

J. B. Woodyatt
Southern Canada Power Co., Ltd. Montreal, Que

Treasurer:

C. Johnstone
Southern Canada Power Co., Ltd. Montreal, Que

Secretary:

Louis Kon
Montreal Light Heat & Power Con., 301 Power Bldg. Montreal, Que

N. S. Braden
Canadian Westinghouse Co., Hamilton, Ont.

W. A. Bucke
Canadian General Electric Co., Toronto, Ont.

A. B. Cooper
Ferranti Meter & Transformer Co., Toronto, Ont

A. A. Dion
Ottawa Electric Co., Ottawa, Ont.

A. P. Doddridge
Quebec Rly. Light Heat & Power Co., Quebec City, Que

A. Monro Grier, K. C.
Canadian Niagara Power Co., Toronto, Ont.

W. O'Brien
Montreal Light Heat & Power Con., Montreal, Que.

M. K. Pike
Northern Electric Co., Montreal, Que.

M. A. Pooler
New Brunswick Power Co., St. John, N. B.

J. C. Smith
Shawinigan Water & Power Co., Montreal, Que

J. E. Tanguay
Public Service Corporation, Quebec City, Que.

W. H. Winter
The Bell Telephone Co., Montreal, Que

The President
National Electric Light Association, N. Y.

ADVISORY COMMITTEE:

Past Presidents Eligible for Office.

Index to Advertisers

CONTENTS

PROCEEDINGS

Of the Thirty-third Annual Convention of the Canadian Electrical Association, held in the Mount Royal Hotel, Montreal, Que., on the 21st, 22nd and 23rd of June, 1923.

OPENING SESSION

Thursday, June 31st, 1923

President P. T. Davies in chair:

PRESIDENT: For the moment you have to look upon me as the Mayor of Montreal. I wrote our friend the Mayor myself, and asked him to come personally. I said, we do not want you to send up an English Alderman to represent you. We want the real Mayor of Montreal. He wrote me in his usual style, saying he would certainly be here. Therefore we expected him, and I don't know why he didn't come. We have made inquiries and find he is out of town. In the meantime I wish you would look upon me for the moment as occupying the honourable position of the Mayor of Montreal. (applause).

Gentlemen, on behalf of the City of Montreal I bid you all welcome. As you know, Montreal is a growing city—it is the largest city in the Dominion of Canada today, the most important city, the city with the largest population, the financial centre of the Dominion, and, with all due respect to Toronto, we think the most cosmopolitan city in Canada today.

(laughter and applause).

All out of town guests and visitors are very welcome today, and we hope that during your stay here you will take advantage of our Reception Committee's arrangements to see the sights of our City, and if the evenings are nice to go around and look at our fine streets and trees, and occasionally drift out to those places not found in Ontario. (laughter).

Gentlemen, on behalf of the City of Montreal, I have great pleasure in welcoming you here today. (applause.)

Now we come to business. The President is always privileged to bore you for a few minutes, and following along the lines of all previous Presidents, I will take the opportunity to rest my memory and will read you a few words in connection with the work your Association has done during the past year.

PRESIDENT'S REPORT

It is a very great pleasure for me on behalf of our Association to welcome all delegates to this 33rd annual Convention of the Canadian Electrical Association.

I would request you to give the best of your effort towards the development of discussions, so that the Convention will be of maximum benefit to all of us.

I hope that there will be no hesitation on the part of any of our members or visitors to express from time to time their opinions on any subject which may come up, remembering always that while the matter in question to them may be an old story and their opinion based upon experience gained many years ago, that there are present with us today, as at all Conventions, those younger engineers and operating men whose experience is more limited and who possibly have not yet found a personal solution to difficulties which were safely passed by most of us many years ago.

I think we can well look upon our Convention and Committee work, as perhaps of maximum value to the rising generations. With this in view, in filling Committee places, I have endeavored to introduce as far as possible new and younger blood and I think that we may be well satisfied with the work that has been done by several of our younger members who had previously not done any work on any of our Committees.

In reviewing the work done for the past year, as is customary for a President's address, I feel that whatever we have accomplished, that there has been no lack of effort on the part of your Executive to attend promptly to all matters to which its attention has been directed.

There has been general criticism of the Association in past years, from our manufacturing members and others, that the Association has confined itself too much to technical details of operation with some discussion from time to time of problems of management.

Your Association this year therefore endeavored to assist as far as possible the other branches of work, feeling that the technical section can well be left alone. As a result, a very strong Committee was formed to look more closely into Commercial matters and it is our belief that the work of this Commercial Section will be quite noticeable both in the excellent advance reports which we have from the various Sub-Committees, also from the list of speakers whom they have obtained to address our sessions.

Your Executive also has assisted Mr. Paxton Little to build up the activities of the Accounting Section. The presence of Mr. Edwards today, who is known perhaps as the Premier Public Utility Accountant in the world, is just one evidence of their ability to progress.

It is unfortunate that we have to have parallel sessions and that our Accounting Section will sit concurrently with our other sessions this afternoon, but I hope that we will have a very complete attendance of at least all men interested in Public Utility Accounting in Montreal, at these sessions and I believe that some of our executive officers will find it very much to their advantage to listen in at their meeting this afternoon.

We have endeavored also to find some room for and give some attention to our friends the Contractor Dealers. Our Local Section in Montreal held a number of meetings in the Winter at which Contractor Dealers were privileged to be present. The members of your Association also make up a directing force in the various provincial coperative Associations.

The C. E. A. is only too willing and glad to be of greatest assistance possible to all men who are in the great electric business.

Various special matters came up for attention and I will here briefly refer to some of them.

In the Fall of 1922, when our Member-Companies in Ontario were in danger of having their water power rights restricted in an arbitrary way, through a Bill No. 249, which was before the Ontario Legislature, energetic representations were made both through the usual legal channels and also by means of our particularly persuasive past President, Mr. Monro Grier. It is with pleasure that the Association can report that the objectionable clauses to the Bill were removed.

Our Association had its attention drawn to the index figure in the Cost of Living table which was quite unfair to the Electric Light and Power Companies, inasmuch as the item heating was combined with the item lighting in all tables. Representations have been made and comprehensive data gathered, whereby the Minister of Trade and Commerce was enabled to separate out the item lighting from heating, so that in future instead of this item showing apparently that lighting in 1923 is 188% of 1914 prices, it will show a decrease in the average cost of lighting per family during this period.

Our last advice from the Minister, is that he has all the information necessary, that his Statistical Department is working on the average figures and that it is their intention to make the change in some form or the other at an early date.

Our Committee on Meter Seal Extension, of which I am Chairman, has a blank year to report; representations have not met with the reception that your Association feels is due to them, but inasmuch as the truth finally must come out, I believe that it is only a matter of time until our very just desires in the matter of meter seal extension are met by the Government.

Following along the lines of the wonderful work done by the

Insurance Committee of the N. E. L. A. by which fire insurance premiums have been reduced on an average by 25%, we appointed a strong Committee to investigate the premiums paid in Canada in comparison with the property losses. This Committee will make its first official report at our Class A. meeting on Saturday morning the 23rd, and without anticipating this report I might state that the findings are as expected and that there is ample room for a very large reduction of the fire insurance premiums which your Member Companies have been paying.

Class A. members are earnestly requested to attend our meeting on Saturday morning, as your Committee feel that they should have some direction with regard to further steps which should be taken to make effective the recommendations of our Insurance Committee.

The Association was called upon to make the first presentation of one of the medals for resucitation by the prone pressure method, available under the Julian C. Smith foundation. It was particularly pleasing to the Canadian Electrical Association that the first award should be made to an employee of a Utility outside of our ranks, .to an employee of the Hydro Electric System of Ontario. We feel that nothing but good can come of our marching together along the lines of humanity with all progressive forces, even if we are unable to see eye to eye with them in regard to their indifference to the policy of private ownership.

Various appeals were sent to both individuals of Member-Companies and your Executives to attend some of the sittings of the Gregory Commission, with a view to presenting evidence tending to discredit the Hydro Electric System of Ontario.

Your Association, while insistent upon guarding the rights of its own Member-Companies to live and fill a legitimate and protected place in our modern social structure, is quite satisfied that time alone will show to the owner of property in Ontario and also to the people at large, the economic impossibility of operating for any length of time those necessities which history has again and again proved can only be run permanently by private agents.

The Association does feel that it is unfair for any governmental body, such as the Hydro Electric Commission of Ontario, to escape the payment of the normal taxes incident to the operation of such a system by private ownership.

The fact that the Hydro Electric Commission in its operation pays neither income tax to the Government of the country, or any Provincial taxes whatsoever, is benefiting the few customers in Ontario at the expense of not only the non-users in Ontario but also every other person in the Dominion of Canada.

When this freedom from taxation is carried to the limit that the Hydro Electric System pays no sales taxation on the appliances which it buys for resale, a legitimate ground for criticism is

present among those dealers in Ontario who have to sell in competition with such merchandising outlets.

In February of this year, the Income Tax Department of the Dominion Government, planned to treat bond interest as a profit and not as an expense. Your Association immediately gathered together opinions from Member Companies and added their representations to others, which finally had the effect of, for the time being at any rate, disallowing this suggested interpretation.

In answer to several requests, a list has been prepared, showing the rates of wages paid for different electrical occupations in different parts of Canada; this list is on file at the office of the Association where reference to it can be had at any time.

Your Association has had numerous calls upon it to appoint members to act on various Committees on matters affecting the industry. Appointments have been made of those members who have been available for such duties and your Association feels that they are very well represented in all matters that affect the interest of Public Utility Companies.

The Dominion Government is taking an active participation in the World Water Power Conference, taking place in June 1924. *Your Association was called upon to assist in these matters and out of five papers which are to be presented at the exhibition in connection with the exhibit, three of them are to be prepared under the guidance of three of your members as follows:*

Transmission and distribution of electric energy.

By Julian C. Smith, working in co-operation with other engineers to be chosen by himself.

The application of hydro-electric energy for Public Utility purposes.

By P. T. Davies, acting in co-operation with other engineers.

The financial aspect of power development in Canada.

By Sir Herbert S. Holt.

The Association feels very much honored in this choice and trusts that all requests for information from these gentlemen will be readily given to the best of the ability of our Member Companies.

It is essential that the reports on the above very important matters should be complete and authoritative.

Our Membership has been kept at a fairly satisfactory figure notwithstanding the great loss to our Association of the Companies in Toronto taken over by the City of Toronto in the recent clean up.

Your Association suffered financial losses which can be sustained and also suffered a loss from the ranks of membership of many men who had been actively identified with the Association

for many years and whose help was of great usefulness in the carrying on of all branches of the Association's activities.

You will note from our Treasurer's report, that we have been as economical as possible without leaving undone any essential work. Owing to a change in the arrangements for Secretarial duties, we have had to not only absorb the honorarium which was attached to our late Secretary's work for the last year, but also to provide monthly Secretarial expenses for this year; as a result, our cash position is somewhat different from last year.

By the exercise of economy, particularly in printing, we have been able to present what I consider an excellent statement and also turn over to the incoming administration a financial position which will be practically paid up as regards outstanding accounts and obligations.

In conclusion, the Vice-Presidents and myself want to record our personal appreciation of the support which has been given us both by our Secretary Mr. Kon, our Treasurer M. C. Johnstone, who have carried their load of work cheerfully at all times, and also of the Chairmen of our four main sections and of different men who have worked unceasingly to complete their reports, which we now have before us.

At the same time, in addition to the written report, I want to bear witness to the splendid assistance and help we have had from the Executive Officers of the N. E. L. A. It has been my privilege to be closely in touch with the NELA throughout the year, both receiving and giving information, and I must say that our connection has been extremely satisfying. I think that our connection with the NELA is the best thing we have in our Association today.

Just one other word. In connection with this Convention, gentlemen, I have a slogan in my mind which I think might go well: "Information and Informality." It is my desire that this Convention should proceed along as informal lines as possible. The weather is hot, and as a result we are going to be somewhat taxed to keep going, so I want you to feel at liberty at all times to leave off all superfluous articles of apparel, and if you want to come in flannels later on, it will be quite satisfactory to us. The dinner tonight is informal in the strictest sense of the word. Anybody who wants to go to the dinner and dance tonight in flannels is perfectly able to do so. It will be strictly in accordance with the etiquette of the occasion. I have nothing more to say.

(applause.)

President:—The next item on the programme is the report of the Secretary, Mr. Kon.

REPORT OF SECRETARY.

Mr. President and members of the Canadian Electrical Association:

The duties of the Secretary are very concisely described in section five of the constitution, ending with: "He shall perform such other duties as the President and the Executive Committee shall direct."

If there was any deviation from this directive during the year of the Association just now coming to an end, I sincerely hope that it will be frankly called to the Association's attention.

Not because I am inviting either censure or praise, but as a material aid to whoever shall be elected Secretary for the year to begin after this Convention is over as well as for the benefit of the Association and the individual members.

I am looking back at the work performed during the past twelve months with a great deal of pleasure indeed, first because of personal benefit I have derived through gaining considerable knowledge and experience, and secondly, as an officer of the Association, I am able to share in the satisfaction that a fair amount of useful work was accomplished and that strict economy was exercerised in executing the work.

The Secretarial work during the year was quite heavy, which may be judged by the fact that over 6,000 pieces of mail were sent out by the Association and a corresponding number of letters, requiring personal attention, was received.

The various committees were helped along by all manners of assistance, which probably accounts, to some extent, for their fairly frequent meetings during the year, this being particularly true of the Commercial and Accounting sections, fuller development of which began just recently.

I would only repeat the statements just made by the President were I to go into detail of the work undertaken and accomplished during the past year, but, as the Secretary is in close contact with all phases of the Association's work, I may ask your consideration of a few remarks.

I feel very strongly from an earnest study of the work carried on and accomplished by the National Electric Light Association, that there is more diligence and eagerness among the membership at large in seeing through the purpose of the Association than is the case in our own Association, also that the Executives of their member Companies are looking upon the work of the Association much more as a matter of good business, encouraging the taking of active interest in that work among their officials and employees by active personal participation.

We have in Canada a splendid example of what can be accomplished by an Association for financial and professional benefit

of the members and industrial advancement of the nation. if we look at the Pulp and Paper Association.

Are our opportunities not greater than theirs?

It was only a trifle over four decades ago that a Canadian newspaper suggested the use of convict labour to work treadmills to charge secondary batteries. and today we have well over three million H. P. developed by water wheels and turbines alone.

From the educational point of view the responsibilities and tasks of our Association towards the public and people engaged in the electrical industry are increasing with great rapidity, and the need of self protection against ignorance of individuals, groups and bodies are growing daily.

The accomplishing and combating of either can be assured only by a strong, well supported, well understood, active and progressive Association which, no doubt, everyone of our members wishes the C. E. A. to continue to be, but which can be only achieved by actions, vision and leadership.

Louis Kon, Secretary.

L. Kon:—Perhaps, Mr. President and gentlemen, the report that I have just read is not the usual type of a secretary's report. I feel that a convention like this one is just the place where we should speak quite frankly, and I believe that this Association should be the extension course for all branches of knowledge that are required of men connected with central stations.

President:—We will now have the report of the Treasurer, Mr. Johnstone.

C. Jonhstone:—Mr. President and gentlemen, the duties of Treasurer in an Association of this kind are very slight—all he has to do is to get the money handed to him and put it into the bank, and keep from spending it. My report is very brief, and has been pretty well covered in the President's address already.

I have here the audited statement of McIntosh, Cole and Robertson, which I will just read out:

REPORT OF TREASURER—YEAR 1922-1923

At the beginning of the present year the books of the Association showed a balance brought forward of $5,650.95 composed of:—

Cash	3,190.15
Victory Bonds	2,460.80
	$5,650.95

We close the year with a balance of $4,517.34 made up as follows:—

Cash	1,526.54
Victory Bonds	2,460.80
Accounts Receivable	820.00
	$4,807.34
Less Accounts Payable	290.00
	$4,517.34

At first sight, it would seem that Operations had resulted in a loss of $1,133.61, but when attention is drawn to the fact that, when preparing last year's financial statement, no provision was made for accounts payable and then outstanding, totalling some $1,400.00, and when it is explained that in this year's expenditures are included both last year's Secretarial Honorarium of $1,000, and the present Secretary's salary to date for eleven months ($1,100) it will be readily seen that the financial condition of the Association has actually been improved by approximately $1,300, and this despite the fact that Membership dues, for the present year, totalled some $1,300 less than those received in the previous year.

At the present time the membership dues arrears list is very heavy, and the figures quoted as comprising the balance do not include anything to be collected from this source. Undoubtedly many of the members now in arrears will make payment (as a matter of fact several subscriptions have been received since this statements was compiled) so that the present surplus shall be increased in due course.

CHAS. JOHNSTONE, *Treasurer.*

MONTREAL, 20th. JUNE, 1923.

The President and Members,
Canadian Electrical Association, Inc.,
Montreal.

GENTLEMEN:—We have audited the Books and Accounts of your Association for the Period 1st. June, 1922, to 20th. June, 1923, and have verified the attached Statment of Receipts and Disbursements.

We have checked the Dues received with the List of Members handed to us. Arrears amounting to $351.00 have not been included in the Statement.

Respectfully submitted,
MACINTOSH, COLE & ROBERTSON, *Chartered Accountants*

STATEMENT OF RECEIPTS AND EXPENDITURES FOR PERIOD, 1st, JUNE 1922, TO 20th. JUNE, 1923

RECEIPTS

BALANCE, JUNE 1, 1922.				
Cash in hand		$3,155.50		
Cash on Hand		34.65		
Victory Bonds due 1933 (Par $2,500.)		2,460.80		$5,650.90
MEMBERSHIP DUES—				
Class A:				
fixed	$1,490.55			
percentage	2,220.24			
		$3,711.09		
Class B		447.00		
Class C		75.00		
Class D		1,200.00		
Class E		157.00		
Class F		290.00		
Class G		61.00	$5,941.09	
Income from Advertisements in "Proceedings"			1,620.00	
Interest from Victory Bonds			137.50	
Miscellaneous Income			37.00	$7,735.59
				$13,386.54

EXPENDITURES

N. E. L. A. 50% of Membership Dues	$2,970.55	
Local Sections —50c per Member	60.00	
Honorarium — Sec. Treasurer. E. Vinet. (1922)	1,000.00	
Salary and Office Allowance— Secretary (11 months)	1,100.00	
Proceedings (1126.97 pertaining to 1922 Convention)	2,004.00	
Convention Expenses	364.37	
Printing and Stationery	668.17	
Office Expenses	664.22	
Miscellaneous Expenses	37.19	$18,869.20
BALANCE at JUNE 20, 1923.		
Cash in Bank	1,434.27	
Cash on Hand	92.27	

Victory Bonds due 1933 (par $2,500)	2,460.80	
Accounts receivable — Advertisements in 1923 Convention Advance Reports	820.00	
	4,807.34	
Less — Accounts Payable	290.00	$4,517.34
		$13,386.54

Audited and verified subject to our Report of this date.

MACINTOSH, COLE and ROBERTSON, *Chartered Accountants*

Certified Correct.

Montreal, June 20th., 1923. CHAS. JOHNSTON, *Treasurer.*

If I am in order, Mr. President, I would like to make a suggestion here. If I am not in order I stand to be corrected. It is this. We have a very live Membership Committee, and I do not know just exactly how that Committee operates, although I expect its duty is to get new members, which is very good. But I have the idea that an old member is just as valuable as a new member, and my suggestion is that, that the Membership Committee, instead of devoting all its time to acquiring new members, should devote some of its time to keeping the old members in good standing. It is pointed out in the report that there are some $351 of arrears In looking over the list of names, I know the omissions are more accidental than anything else, because some of the names are of men long associated with the Association, and I am sure it is just a question of a few days until the money comes in. (applause.)

President: - Gentlemen, I am very touchy upon this question of the Treasurer's report this year, because I am very anxious to put the Association ahead. At the same time, we did find a large number of outstanding accounts from last year's work that had to be absorbed, but with economy I felt we should break even. According to our Treasurer's report (and I am sure his accounting is prepared along the lines of the NELA'S Classification) we do find actually speaking, although we have dropped some $1,500, we are really $1,300 ahead of last year's mark. I would like some discussion, if there is any. This is one chance you have of rapping the Executive over the head for being wasteful or the reverse If there is any discussion I would be glad to hear it.

Well, I take it that nobody is a better accountant than Mr. Johnstone.

Next is the report of the Public Relations Committee, Mr. J. B. Woodyatt, Chairman. I would ask Mr. Woodyatt to come forward. (applause.)

REPORT OF THE COMMITTEE ON PUBLIC RELATIONS

Last year you will remember that after studying the work of this Committee of the N. E. L. A., and the methods whereby it could be applied to our own Association, your chairman reluctantly came to the conclusion that our Canadian situation did not permit of the centralization of this work on our side of the line, and that on account of the dissimilarity of local situations and impracticability of frequent meetings, it was felt that more could be accomplished by the organization of local groups than through a central committee.

The situation in this respect has not been altered, but the importance of maintenance of proper relations with the public served is greater than ever, and the organization of local groups to carry on the work of improving and maintaining the relations between the public and the industry is again, and strongly, urged.

This work on the other side of the line has been divided up, and I know of no better way of pointing out the importance and scope of the work in hand, than by repeating the objects of the various sub-divisions.

1. WOMEN'S PUBLIC INFORMATION COMMITTEE: To formulate and put into effect plans for the education of women of the country on the fundamental economic principles of the electric light and power business and the inter-dependence of the public and the industry;

2. EMPLOYEE RELATIONS WITH THE PUBLIC COMMITTEE: To foster, through the executives of member companies the proper education of employees in the fundamental economic principles of the light and power business, in the proper understanding of the inter-relation of the public and the industry, and in the proper handling of complaints and courtesy to the public;

3. PUBLIC SPEAKING COMMITTEE: To organize through the geographic divisions, a bureau of public speakers, national in its

scope, and dealing with subjects pertaining to the electric light and power industry;

4. RELATIONS WITH BANKERS' COMMITTEE: To have general supervision of all co-operative work and investment bankers, bankers, insurance companies, etc.

5. MANUFACTURERS' ADVERTISING COMMITTEE: To induce the large advertisers amongst those interested in the manufacture of electrical materials, as well as those interested in the purchasing and handling of public utility securities to devote a part of their apropriations to the spreading of proper information concerning the fundamental economic principles of the electric light and power businesses, and the interdependence of the public and the industry in addition to committees on local organization of public information, and on uniformity of local regulatory laws;

6. CO-OPERATION WITH EDUCATION INSTITUTIONS' COMMITTEE: Organize public utility schools and university courses;

7. INFORMATION BUREAU, ORGANIZATION COMMITTEE: To organize through the geographic divisions, committees on public utility information.

Proper public relations can only follow satisfactory relations between the Company and its customers, and to assist in promoting the latter the following service suggestions were issued during the past year:

Identification and appearance of meter readers;

Educating employees in the proper use of electrical appliances;

Plans for reporting complaints and submitting suggestions for betterment of service;

The business of your company is to render service and courtesy to the public;

Proper location for meters;

Telephone orders for better service;

Improving service rendered to outlying communities;

The practice of disconnecting and reconnecting meters in the New York and Queens Electric Light & Power Company; and our member companies are urged to give these suggestions their consideration.

Customer Ownership

As reported last year, it was felt that the ownership of the securities of the companies by their customers, and the education of the public necessary to bring about this ownership, was probably the greatest single factor in the betterment of relations between the public and the company, and your chairman is still more than ever convinced of this, and that our member companies should use their greatest endeavours to promote the policy of customer ownership in their respective fields.

The movement is going ahead by leaps and bounds. 156 companies reporting to the NELA Committee on Customer Ownership show the following:

Summary By Years

Year	Shares of Stock Sold	Stockholders Obtained
1914	92,310	4,044
1915	57,103	4,357
1916	38,057	3,681
1917	79,348	7,470
1918	30,783	4,115
1919	166,096	20,840
1920	416,089	62,885
1921	802,845	118,177
1922	1,750,707	198,018
	3,433,338	423,587

Stated in Par Value of $100 Per Share

The increase in 1922 over 1921 is most marked and gratifying.

Advantages of This Policy

In the State of California the advantages of this policy were recently put to a severe test. The California companies have made remarkable progress in promoting customer ownership, so that today a great percentage of their customers are shareholders. The Southern California Edison Company have over 50,000 shareholders amongst their 200,000 customers, the Pacific Gas and Electric Company have 30,000 shareholders amongst their 700,000 customers, and the smaller companies have made equally good showings, so that when the Government of the State proposed to raise a fund of five hundred million dollars with which to go into the power business, the plan was defeated at the polls by a vote of over four to one; and an analysis of the votes against the plan in the individual municipalities showed that they were directly proportional to, and almost directly traceable to, the customer owners of the various companies.

Southern Canada Power Co's. Experience

The company with which the chairman is connected took the plunge last fall, and as a result practically 10% of the customers of this company have now a financial interest in the success of the company; and the first effort will be shortly followed by another one, and then others, until such time as the greater number of the community served are financially interested in the company serving them. The Southern California Edison Company in the west, and the Central Maine Power Company in the east, both have something over 25% of their customers as shareholders, and it seems hardly necessary to point out the advantages accruing both

to the company, its shareholders, and its customers, when every fourth customer is financially interested in the success of the company, and there should be no let up in our endeavours until this percentage thus known to be possible of attainment is reached in our own respective districts.

The policy of customer ownership has not as yet made any great headway in this country, but the time is ripe and much can be done during the coming year, and we would again strongly recommend that the matter of organizing a campaign for the sale of securities to its customers be given consideration at the earliest opportunity by each member company. Improvement of relations between the public and the company in any locality is bound to have a beneficial efect in other localities, so that anything that is done by a member company will not only greatly improve its own position, but also improve the general situation to the benefit of the the entire industry.

Jas. B. Woodyatt, *Chairman.*

(applause)

President: Gentlemen, the matter of public relations is a very important one. I hope to have a general discussion upon the question of Customer Ownership, and now is the best time to have it. We will be having Mr. L. C. Haskell's paper Saturday morning on Customer Ownership as such, but inasmuch as there are several gentlemen here interested in this matter, perhaps not Class A representatives, I will be glad for their benefit to have some discussion that can be raised upon the question of improving public relations through customer ownership. This is a very important subject.

I can see there is a certain amount of bashfulness prevailing. I would like to start some discussion early in this Convention, so that we will not run through our reports without getting some comments from the floor. I would like to get some assistance right away. Perhaps Mr. Haskell might give us a few words.

L. C. Haskell: It is a very large subject, and I think if the members companies' representatives would ask questions, that the points of interest would come out better than through any discussion that might be started by me.

President: You might take a few intimate examples of the benefits of this at the moment, and tell them how in our own Company — the Southern Canada Power Company — we have Customer Ownership. We have at the moment one thousand people watching that our line gang perform their work properly.

L. C. Haskell: I believe there have been a number of stories published of the working out of Customer Ownership in the Companies on the other side of the line, although we have not published many of the instances that have come to our notice since our

campaign last fall. One of them that comes to mind is the case of a lady who advised us that she was having difficulty with her meter, and made complaint to our local representative. He was unable to find any trouble with the meter, and reported it to our Meter Department. In the course of a few weeks, the head of our Meter Department was in that territory, and went to have a look at the meter. When the lady came to the door he said that he understood she had been having difficulty with her meter. She said: "Oh no, I have forgotten about that. I have just received a cheque for my dividend. I am a shareholder of the Company."

(laughter)

Another case where one of our construction gangs needed the services of a carter, and located a man who would do the carting for us what seemed to be a much lower rate than the current rate charged by the other carters. One of our fellows was curious to know his reasoning in the matter, and asked him why he charged less than the other carters. "Well, he said, I am a shareholder of your Company, and want to see the Company get a square deal, so I will do it at the right price." (Laughter and applause.)

W. O'Brien:—In what other parts of Canada have they had Customer Ownership Campaign, besides the Southern Canada Power territory?

J. B. Woodyatt: I had the pleasure of attending the NELA Convention a couple of weeks ago, and they had a splendid exhibit there, in the form of a large map, with pins stuck in to show the towns in which Customer Ownership campaigns had been carried on. There were noticeable spots where there were not any pins, and those where they were in pretty thick. I was very sorry to see, and report to you, that the whole Dominion of Canada was blank with the exception of the little section covered by the Southern Canada Power. I do not know whether that is actually the fact or whether the companies do not report, but as far as I can judge it is pretty well representative of the truth. We are away behind the times, and I don't think we are doing our duty on this side of the line in that respect.

President:—I am particularly interested in this matter, because Customer Ownership, without doubt, is the solution to any possibility of competition from government owned sources. When you have 15 or 25% of your customers as shareholders, which amounts to practically 25% of the people who have votes in the territory owning your stock, you may depend upon it that the organized minority will look after their own interests. We have to be prepared at all times. We have to protect ourselves. The best way to protect ourselves is to get our own customers interested in the affairs of the Company.

From the other point of view—the point of view of checking

us up — it is a good thing also. We have had some complaints already about our men loafing on the job. I think it is perfectly reasonable that they should complain when they do think they see something like that.

If there is any more discussion or thought on the matter, this really the only opportunity we have to talk about it. Perhaps Mr. Gilchrist might give us a word on it.

Mr. J. F. Gilchrist:— Mr. President and gentlemen of the Canadian Electrical Association, Customer Ownership was rather an experiment with us, as a matter of getting money and getting it cheaply, as we wanted it to extend our business. It has been a good deal of a hobby with me, and if you will take it that there is not intended to be any glorification of self in anything I say, the best thing I can do is to tell you of our own experiences.

We started in a very small way three or four years ago. We wanted the money, and we were rather at a loss to know under the conditions which prevailed then, just how to get it. We knew that throughout the United States in a good many places notably successful campaigns had been carried on, but we had two thoughts in mind which caused us to hesitate. First was the question of whether or not it would be quite dignified; i. e., whether there would be unpleasant reactions as the result of going out after very small stockholders in a peddling way. That was three or four years ago, and we have changed our views quite radically in the meantime. The second thought was that if we got a great number of owners of stock in these companies, and some fellow took it into his head to try and organize them, they might make it unpleasant for us; we had heard of one or two cases of customer ownership where securities had been sold several years ago before the period of depression, and where when conditions came along that were not as happy as they might have been, there was a good deal of discussion. However, we came to the conclusion, that all things considered the advantages more than offset the possible objections and decided to proceed. We started in a rural district company of ours, which operates in the center of the State of Illinois, and organized our own employees into teams to carry on the sale. At that time there was a good deal of opposition to paying any consideration to these men. They undertook the work as a matter of loyalty to the Company. The sale was fairly successful. We sold two or three thousand shares of stock — at that time selling preferred stock, which was paying 6%, and which sold for about $81. or $82. per share. We found that the stock went in very small units — two shares to each customer was the average. The period of payment was 16 months — $5.00 down and $5.00 a month. One of the things which we learned in that sale was that it was unreasonable to expect our employees, without remuneration, to continuously carry on work of that sort. If we

were perfectly willing to pay money to banking houses and corporations for the sale of our securities, there was no reason why we should not pay at least a proportion of that amount to whoever did the work. So we switched at that time, and while we hear from many sources of companies that have been successful in having their customers come in and buy securities over the counter, we have never had that experience. We have had to go out and drive for everything we got.

While I say drive, the greatest part of the effort is selling your own people, and getting them into a state of mind where they appreciate the fact that they are really doing quite as much for the customer in selling them good safe securities as they are for the Company. There are a great many desirable things which grow out of this exchange of ideas. In the first place I don't know whether you have the experience we have but in many of our companies there are certain classes of men who are not, when you get down to the fundamentals, or were not, as loyal as they might be. That probably was our fault as much as theirs—perhaps we didn't inform them as we should have.

The very first result of getting all those people into a movement of this sort is to develop a very great and growing confidence on their part in their own Company. They feel first that they are being taken into confidence, and as they study and understand the financial structure of the Company, and all there is to know about it, which they must know if they are going to go out and sell securities, they get confidence in the institution which they wouldn't have gotten in any other way. In that way it has been a very beneficial thing. It is a very fine thing, too, from the standpoint of being able to put loyal employees who are anxious and willing to work for you whenever the opportunity arises, and talk for you, in a position to make something in excess of their regular income, which will be directly in proportion to the amount of activity they display. The amounts which we pay our men range from $1.00 to $2.50 per share. We generally sell on both a deferred payment basis and cash basis, and we pay a little higher commission to the salesman who brings in the cash, although we have begun to think lately that possibly that is a differentiation which is not desirable, because requiring cash sometimes hinders making a sale which would otherwise be very desirable. I do not know of any safer proposition from our standpoint, or more desirable, than selling large quantities of securities on a basis where they are being paid for over quite a period,—from ten to twenty months. You have to sell a larger amount, of course, to give you the money which you need for your immediate use. However, as I say, we have differentiated in favor of cash sales, and on sales of securities of our best known and strongest companies on deferred payment, we pay a minimum of $1.00 per share, ranging

up to as high as $3.00 on stocks sold for cash of some of the companies which were not so well known, and which operated a long way from Chicago, our center. You can readily see that when we are selling stock in Chicago of the Commonwealth Edison Company, naturally it is a very much easier proposition than in cases where we are selling securities of one of our country companies, as for instance, the American Public Service Company, which operates in the state of Texas, because, naturally, salesmen have to do a great deal more educating in the case of a company so far afield. This movement has been so successful with us, it has resulted in the development of a securities company, which is owned entirely by our principal utilities. This company of ours is owned by the Commonwealth Edison Company of Chicago, the Peoples Gas Light & Coke Company, the Public Service Co. of Northern Illinois (a company which operates in the suburban territory around Chicago), and the Middle West Utilities Company, (a holding company in our group, which owns utilities operating in several states). These four companies own the Utility Securities Company, and we advertise on the letterheads and in all such ways that it is the investment department of these Companies, which ties it in very closely. That company employs quite a large number of men, who work on nothing but sales of securities. At the present time I think it is fifty or sixty. When we have a big issue of shares which we desire to sell in a short time, we bring into it our employees organization, and thus have six hundred to one thousand men and women working under the supervision of the Utility Securities Company, but it is the employees of the Company who sell these securities. The plan is growing remarkably. The last year or two in the Commonwealth Edison Company we have followed the English idea of having large stockholders meeting. We have had twelve or fifteen hundred people at our stockholders meetings, and I think that the time may come when we will engage the biggest auditorium in Chicago and try and get a larger number of our stockholders together. We were a little apprehensive when we first got fifteen hundred people together, as to whether any argument might come up some person, not realizing that he was doing anything in the way of heckling, might ask some difficult questions perhaps, to illustrate his knowledge of the situation. There was nothing of that sort at all. Instead of this some man we did not know anything of got up and made a fine speech, suggesting a vote of thanks to the officers of the Company, and so it moved off very nicely. Last year in addition to having a large crowd in, we had instruments on the table enabling the Chairman to broadcast the meeting and it was received we know by a very large number of our stockholders who were not able to be present. All this has had a fine public relations effect.

You were speaking of little anecdotes. This one may have reached you down here, but on the chance that it has not I will tell you. It happened to Mr. Pack, who many of you know very well, he was in Toronto and now is in Minneapolis. In talking with him about Customer Ownership, he said he had a couple of stories to tell me that illustrated the value of it. They raised their prices on two occasions. One day a few weeks after the second rise, a gentleman came in to his office who he didn't know, and said: "You don't know me, though I am a citizen of Minneapolis, but I happened to be in the building paying my bill, and I thought I would step in to tell you an instance of which I am sure you will be glad to know. When you raised your prices last time, I did not understand the situation as well as I do now, and I felt a little bit sore. It seemed to me it would be a good thing to stir up agitation to see if we could not head the increase off. I wasn't much of an organizer myself, so casting about in my mind for a man who would be useful, I thought of a fellow who was a neighbor of mine, and that night my wife and I went over to his house and I started right in to tell him what an outrageous thing it was. He listened patiently and finally said: "Well, now, I know it is pretty hard, but really there isn't anything else to do. We have gone into the thing most carefully, and there does not seem to be anything else to do." What is all this "we" stuff, I said in surprise? 'We, why I am shareholder in the Company! I go to see Mr. Pack very often to talk things over with him. Are not you a shareholder? On my replying that I wasn't he said: 'Well, they must have missed you.' " (Laughter.)

That was one of the stories he told. The other was as follows: I was lunching one day with the Mayor and City Treasurer and the Mayor knowing all about this movement, said: "How is the stock sale going?" "Pretty good," I answered. "How many shareholders are there in Minneapolis now?" "We have six thousand," I replied. He winked at the City Treasurer and said: "You can see how it works? That would mean each one of those six thousand probably controls four or five votes. I guess that would swing any election for Mayor in Minneapolis." (Laughter.)

In our own sales there are a great many little incidents that come out. We have one man, a kind of fitter and repair man—who has been very good in this work, and by the way, I have noticed—that that type of man seems to take to this work. Our operating men and trouble men and so forth, are sometimes a good deal better on this work than our salesmen or inside people. In the town of Harvey, south of Chicago, there was a woman who had not paid her gas bills for several months. She threw the collector out, so this man I have spoken of was sent up to cut this woman's service off—he was sent out with instructions not to come

back until he had either cut off her service or gotten the money. So he went up, and when he came back the first thing he did was to plank down the money for the arrears. The clerk said "How did you get it?" "I just talked to her about an hour and she paid up," he replied. "Yes, I have the money, and I have her subscription for three shares of stock besides, and the money for that."

(Laughter)

I recommend Customer Ownership very highly, but don't go after it in a half hearted way. Don't think, if your people are anything like the Chicago people, that you are going to be able to sell by inviting them to come in and buy over the counter. Don't be satisfied that it is failure until you have worked at it hard for a long time, regardless of early reverses, because it is worth all the effort you put into it, just as a public relations measure, even if the consideration for which we went into it at first is entirely overlooked—that is, getting the money. (applause).

President: Mr. Gilchrist, we are very much indebted to you for talking to us at such length on this important subject.

We are very fortunate, gentlemen, in having with us quite a strong body of men from the NELA Accounting Section, and we

hope to have their assistance upon those subjects they have studied and know so well, during the course of our Convention.

Now, gentlemen, any other word about the matter of Customer Ownership? We have a number of the boys here from the Southern Canada Power Canada, who put over the sale. I would like to call on some of them to say a few words. Some of these men, who did not think they could sell a share of stock in the world, went out and managed to put over one hundred shares of stock in a few days. I was surprised, and I am sure Mr. Woodyatt was surprised too, at the way the results came in. We went out to sell two thousand shares in ten days, through employees only, and except for a directing force, who did not actually make any sales, our boys put it across in three days, and got them in so quickly we had to call them off when it looked like two thousand, and it finally totaled up to 25 hundred shares. Needless to say we arranged for commissions, which is only right and reasonable, and everybody finished it feeling they had done something worth while. As Mr. Woodyatt has said, we are contemplating another sale, and the boys are waiting for a chance to get out and put it across.

Any other word on the Public Relations Committee report? We will then proceed to the next.

We have the report of the Membership Committee, Mr. Pike, Chairman.

M. K. Pike:—The report of the Membership Committee is very brief. As the President mentioned in his official report, we suffered this year through loss of the Toronto Class A members, and their employees. Therefore we have shown a net loss this year. By classes, we had at the beginning of the year 47 Class A members. During the year we lost 4, but were fortunate in gaining 3 new members, so despite the Toronto situation we show loss of only one Class A member. Class B members: At the beginning of the year we had 311—new members 3, loss of 92, net loss of 89. Naturally that is where the largest loss in membership per group took place, on account of the Toronto situation. Class C: beginning of the year 20, new members 1, cancellations 1. Class D: beginning of the year 22, new members 1, cancellations 2, net loss 1. Class E, at beginning of year 157, new members 10, cancellation 1, net gain 9. Class F, beginning 20, new members 3, cancellation 1, net gain 2. Class G, beginning 26, new members 7, cancellations 12, net loss 5. At the beginning of the year we had total membership of 503, loss of 85, so that we ended the year with 418 members.

Naturally, where there is such a large difference in the class of membership, it does not mean very much to say we have three to five hundred members, because one Class A member, as you all know, pays more than perhaps several hundred of other members. That is the way we stand at the end of the year, total 418.

The Membership Committee this year carried on the same type of a campaign as we did last year, but not as successfully. The year before last we were very active, and had a campaign week which increased our membership very materially. If I remember correctly we showed 40% increase the year before. This year we found the grade a little heavier, and for that reason we were not able to get as large a number of new members as we did during the previous year. So we were hardly able to make up the loss due to the Toronto situation. (Applause.)

President: Any discussion, gentlemen, upon this report?

We now come to the reports of the Chairman of the various sections. The general activities of the Association are divided into four main groups. We have the Technical, Accounting, Commercial and Accident Prevention Committees. I would ask Mr. Beaumont to present the overall report of the Committees of the Technical Section. Mr. Beaumont?

Gentlemen, I do not know whether any of you are getting tired, or if you find the seats uncomfortable. Sometimes it is found a good thing to take a little slip around and come back again. Any of you feel tired? Everybody happy? All right, we will proceed.

Mr. Beaumont is not in the room. He is discharging his duties on the Entertainment Committee.

We now come to the section which I am particularly interested in, and which we have developed this year as never before. I will ask Mr. Paxton Little, of the Canadian Niagara Power Company, to present the report of the Accounting Section. (Applause.)

REPORT OF ACCOUNTING SECTION

W. Paxton Little: It has been my pleasure the past year to be actively connected with your Association as Chairman of the Accounting Section, and I herewith submit a report of the activities of this section during the past fiscal year.

The first meeting of the Accounting Section was held on November 1, 1922, at Montreal. This meeting was called to plan the work of the section for the coming year and to select the chairmen for the different committees. It was considered advisable to continue the programme that had been followed in the past of constituting the committees of the Accounting Section like those of the National Electric Light Association and co-ordinate in scope and purpose.

The following committees and the chairman for each were appointed at this meeting.

Accounting Education:	Mr. Louis Kon, Secretary, Canadian Electrical Association.
Accounts Payable Records:	Mr. F. F. Jansen. Ottawa Electric Company.
Budget Committee:	Mr. C. Johnstone. Southern Canada Power Company.
Classification of Accounts:	Mr. F. W. Fee. Ottawa Electric Company.
Customers' Records and Billing Methods:	Mr. J. J. O'Brien, Quebec Railway, Light. Heat & Power Company.
Fixed Capital Records:	Mr. J. Bailey, Shawinigan Water & Power Company.
Pay Roll Standardization:	Mr. F. Johnson, Bell Telephone Co. of Canada.
Purchasing and Storeroom Accounting:	
Securities Holders Securities:	Mr. L. C. Haskell. Southern Canada Power Company.

Mr. J. Bailey was appointed Vice-Chairman of the Accounting Section. but as he would be unable to serve on account of absence from the city. Mr. F. W. Fee of the Ottawa Electric Company was appointed in his place.

At the first meeting of the Accounting Section we were honored by having present Mr. P. T. Davies. President of the Association. and Mr. Fred W. Herbert. of New York, of the National Electric Light Association. Mr. Davies addressed the meeting, expressing the hope that even if the time were brief the members should begin their activities at once and asking all members to make their reports for this year as complete and instructive as possible.

Mr. Herbert was present at this meeting at my earnest request. my thought being that Mr. Herbert could give us some interesting and helpful suggestions by describing the work of the several committees of the Accounting Section of the National Electric Light Association and by assuring us of the co-operation and aid of National Electric Light headquarters. His account of the activities during the past year in securing the adoption of the Uniform Classification of Accounts by as many States as possible was inspiring and demonstrated the value and importance of uniformity in accounting. He expressed the opinion that the Canadian Electrical Association should give the matter of the adoption of the Uniform Classification of Accounts very thoughtful consideration and if possible adopt the classification as standard if it is found to meet their requirements.

The interest and enthusiasm displayed by those present at the meeting were very gratifying. The opinion of all present was

that meetings should be held oftener, so it was decided to hold meetings of the section on the first Tuesday of each month.

The chairman of the respective committees were urged to communicate with chairmen of similar committees of the National Electric Light Association and to obtain from them copies of their reports and the minutes of their committee meetings so as to become familiar with the work of those committees. In this way helpful ideas might be gained to form a basis for beginning the work of this section and that of the committees composing it.

Mr. Herbert kindly offered to send to the chairmen from headquarters complete sets of the last reports of the National Electric Light Association committees and such other matter as would be useful in carrying on the work. Mr. Herbert's courtesy in promptly carrying out this offer is gratefully acknowledged.

It was also recommended to the chairmen of the respective committees that they appoint from the accounting staffs of their companies members to serve with them on their respective committees and generally to create a lively interest in the Association's accounting work.

Meetings were held during the year as follows:

Montreal, November 21, 1922;
Montreal, December 19, 1922;
Ottawa, February 6, 1923;
Montreal, April 24, 1923.

The attendance at the meetings was uniformly good, the interest of the members was maintained, and at each meeting satisfactory progress reports were made by members of the committees. Sometime prior to the meeting of April 24th, the chairmen of the committees were notified by the Secretary of the Association that their reports should be handed in not later than April 15th, and reports of the committees, with the exception of report from the Fixed Capital Records Committee, were received. These reports were read, discussed, and approved, and advance copies ordered printed for distributing at the convention, later to be made a part of the proceedings. Owing to Mr. Bailey's absence, the Fixed Capital Records Committee has not submitted a report this year and no appointments have been made for this committee. The subject, is a most important one and the report of the National Electric Light Association committee on this subject is recommended for study by all the members of the section.

At the various meetings of the committees I have presented to the members the advantages and opportunities afforded them by attendance at the meetings of committees of the National Electric Light Association Accounting Section, of which they are members. I have also urged upon them attendance at the annual convention of the National Electric Light Association. At the annual

convention of that Association held in New York during the first week of this month, it was very gratifying to note the attendance of a number of the members of the Canadian Electrical Association and their earnest attention and interest in the work. The attendance at the sessions of the Accounting Section was probably larger than ever before, and in spite of the intensely hot weather, the interest was maintained throughout. Mr. Fee, Vice Chairman of our Accounting Section and Chairman of our Committee on Uniform Classification of Accounts, and Mr. F. E. Jansen, Chairman of our Accounts Payable Records Committee, attended the sessions and took part in the discussions. President Davies and past President Grier were present at one session and each of them favored us with an interesting and entertaining address, and at the same time extended a most cordial invitation for the Accounting Section of the N. E. L. A. to hold a meeting here. I am happy to state that the newly elected Executive Committee of the Accounting Section of the National Electric Light Association, of which I have the honor to be Vice Chairman, accepted the invitation and held its first and organization meeting here yesterday. It is hoped that these reciprocal visits of the representatives of the Accounting Sections of the two Associations will bring about greater co-operation, resulting in closer relations and mutual benefit. It gives me great pleasure to extend to the accounting members of the N. E. L. A. a most cordial invitation to be present at the meeting of the Accounting Section to be held in Salon B this afternoon at 2:15. It is hoped that the member companies of the industry will realize more keenly the benefits accruing to them if they will not only permit but require certain of the men on the staffs to attend the meetings of both Associations and to take an active interest in the work

Probably one of the most important undertakings of the Accounting Section of the National Electric Light Association in the past year was its efforts to have the several state regulatory commissions adopt the classification of accounts compiled and prescribed by the National Association of Railway and Utilities Commissioners. This classification has been adopted by a number of the States, is being favorably considered by others, and it is hoped by January 1, 1924, that this uniform classification will be adopted and used by most of the State commissions.

Our thanks are due Mr. Davies and Mr. Herbert for their interest at all times in the work of the section and the encouragement they have given by attending some of our meetings. I also wish to thank the chairman of the various committees for their earnest co-operation. I think we may all feel that our accomplishment in the short time at our disposal has been of such proportion that we may look forward with confidence to the continua-

tion of the work of the section with resultant benefit to the member companies in the industry.

Louis Kon
F. E. Janssen
C. Johnstone
F. W. Fee
J. J. O'Brien
J. Bailey
F. Johnson
L. C. Haskell
W. Paxton Little, *Chairman*

Mr. Little:—I wish to avail myself of this opportunity to express to the Association my appreciation of the honor accorded me in selecting me to fill the office of Chairman of the section. It has been a great pleasure for me to attend the meetings and to contribute of my time and efforts.

At the meeting of the Executive Committee of our Accounting Section held in Montreal, April 24th last, the Committee by a unanimous vote directed me to extend an invitation to the Dean of the Accounting Section of the National Electrical Light Association to be present at our convention and to address us as the speaker of the accounting meeting, and he has accepted our invitation. His visit is most timely and opportune for us just now, when we are endeavoring to build up an intensive interest in our Accounting Section, for he can give us helpful and valuable ideas gained through his many years of earnest work in the conduct of the N. E. L. A. section with its splendid results. I take pleasure in introducing to you Mr. H. M. Edwards, Auditor of the New York Edison Company and member of the Executive Committee of the Accounting Section of the N. E. L. A. (applause).

H. M. Edwards:— Mr. President and members of the Canadian Electrical Association, it is indeed a compliment to be invited to address the Canadian Electrical Association. It is a privilege furthermore to be asked to speak to the newly organized Accounting Section of your Association on matters of accounting procedure matters which may on the surface appear to have a departmental interest only but which really have Company wide significance, and are capable, when their importance is fully recognized, for contributing substantially to the prosperity of the business. The latter at least is the view of the National Electric Light Association which for over a decade now has included within the scope of its activities a highly organized Accounting Section, thus providing the means rfor the public discussion of germain questions and the opportunity for the exchange of ideas among those whose duties lie in that direction.

It is therefore entirely fitting and proper that the newly or

ganized Accounting Section of your Association, in planning its work, should have the benefit of the experience of the National Electric Light Association in similar directions, particularly what advantages it hoped to derive, what has actually been accomplished, and whether the effort has really been worth while. In the belief that such information cannot be otherwise than helpful to you, I have selected as the subject for my address the Accounting Section of the National Electric Light Association, its hopes and accomplishments.

For several years prior to the year 1914, accounting matters were handled at NELA Conventions through the medium of a standing Committee of the Association appointed each year by the President. The reports of this Committee increased in interest from year to year and gained in attendance until the point was reached where special sessions became necessary. The interest aroused by these meetings was so apparent that when in 1914, the NELA adopted its present form or organization consisting of National Special Sections, the Accounting Section was accorded an equal place with the Technical and Commercial Sections and henceforth became one of the recognized departments of Association activities.

At the meeting of the Association held in Philadelphia in 1914, the Accounting Section of the NELA was duly organized. The purpose for which it was organized and the results it was hoped would follow such organization are summarized fairly well in the address of the presiding officer of that meeting, and with your permission I will quote several passages therefrom:

"Undoubtedly the most important work confronting this meeting is the completion and final adoption of a classification of accounts, standardized in its form and contents in accordance with the views of this Association as to what constitutes a proper and necessary system of accounts wherein to record the infinite variety of transactions common to the electric lighting industry. Such a classification of accounts based upon knowledge and experience acquired in the actual conduct of the business must be valuable to our member companies as well as helpful to Public Service Commissions required by law to prescribe uniform systems of accounts. Publicity is a fundamental requirement of governmental regulation and the principal means by which the status of a company's affairs can be ascertained is through the medium of the accounts. It therefore follows that the standing of a company in the estimation of a commission and hence of the public which it serves will be largely determined by the character of its records and the accuracy with which they are kept.

"As we consider the conditions prevailing in the business world at the present time, we cannot escape from feelings of unrest, doctrinaire agitation, social vagaries, unsound and uneconomic

conceptions in regard to the status of invested capital are only a few of the disturbances, and in the very midst of the turmoil we observe public service corporations under attack from all these discordant elements.

"Although we may confidentially rely upon the good sense of the people to settle all these questions equitably and fairly, this should not blind us to the fact that we have a part to play if a just settlement is to be effected. The accountant in a public service corporation is in the very best position to detect the presence of false doctrines and their evil effect upon the enterprise with which he happens to be connected. His position gives him a bird's eye view of operations all over the field. Each activity is finally grounded in his records and he should be the first one to detect the presence of detrimental influences and he should therefore be the first one to raise the alarm. The accountant should, it seems to me, be a close student of the economic literature of the day. Interstate Commerce hearings, rate cases before public service commissions, opinions of commissions and courts, periodicals of the day, all contain matter which should make intensely interesting reading for him. When his company it attacked, it is from his records primarily that ammunition must come for the defense, and those selected to conduct the case will be greatly strengthened if they find, ready to their hand, the necessary data intelligently selected and concisely arranged so as to exhibit at once their bearing upon the points at issue. All this lies well within the domain of the accountant and I am convinced that although there is now laid upon him added responsibility, he is also furnished with a great opportunity."

PROCEEDINGS

The accomplishments of the Accounting Section in so far as they relate to work performed are contained in the Published Proceedings issued by the NELA yearly. Here will be found the reports of the Standing Committees of the Section and the papers read by individual members on miscellaneous subjects and the debate thereon. Each year also a bibliograhpy in topical form is prepared showing by reference to year, volume, and page of the Procedings when a particular topic was the subject of discussion. There are one or two matters in the Proceedings that I shall want to talk to you about later, but it is unnecessary to take your time otherwise. The Proceedings as a whole, however, deserve comment. They constitute a manual of theory and practice on almost every conceivable phase of accounting activity. Books dealing with the theory of accounts written by economists, college professors, etc. are endless in number and varied in quality. In the Proceedings however we have the practical application of the theories — a recital of problems met in actual practice, all contributed by ex

perienced men whose life has been spent in finding solutions to those problems. The Proceedings are a unique and valuable contribution to the literature of the business, and practices which have been found most useful and adaptable to present day conditions. Any company therefore seeking to modernize its present accounting system in any particular has immediately available the best thought of the industry as to how the desired result may be accomplished.

VALUE — COMMITTEE WORK

Right here it is timely to say a word in regard to committee work. When a man proceeds to put down on paper his knowledge of a particular subject his mind necessarily canvasses that subject in all its bearings. Let us say, for instance, that he has been appointed a member of the committee on Customers Accounts and Billing Methods. His knowledge of this subject at the outset is naturally based on the practices followed in his own Company. Accustomed to this routine, he has probably accepted it unthinkingly. Now however he begins to review the routine in all its details. Weaknesses appear, lack of cohesiveness in the different steps develop. He discovers opportunities for improvement. From being a blind follower of established custom he has become an enquirer, with all the latent possibilities involved in that change in his mental outlook. His Company must in the end benefit by this improvement in his character and capacity, even although the Committee work may involve some loss of time and slight expense.

EDUCATIONAL COMMITTEE

The first of the matters contained in the Published Proceedings of the Accounting Section of the NELA that seem to invite particular comment is the work of the Educational Committee. To appreciate the value of this Committee's work we must first understand the conditions under which young men enter the business. These recruits, in the office forces at least, have generally had a common school education. Sometimes they have been through the high school--but rarely beyond. Beginning at the bottom they gradually, as they proceed, acquire a certain facility in handling the immediate work assigned to them. But lacking a knowledge of bookkeeping as a science even in its elementary aspects, they fail to visualize the meaning of their work, are unable to connect it with the other activities carried on in the office, and their upward progress is delayed and hampered for the want of early theoretical training. Many of these young men are in small communities having no so-called continuation schools, and with every desire for self education are yet without the means. The Educational Committee of the Section was appointed to correct this condition. It

has now a well established correspondence course open to all employees of affiliated companies at what is really a nominal rate. Correspondence courses are not novelties, but this particular course is notable in that in addition to the elementary course it has provided an advanced course, the lessons in this advanced course being prepared or vised by well known men in the industry. More and more employees are subscribing to these courses until the point has been reached where the enterprise is on a self sustaining basis. I am not here as a book agent, but the Canadian Electrical Association, being affiliated with the NELA, the courses are equally available hereabouts.

UNIFORMITY IN ACCOUNTING CLASSIFICATIONS

The other matter which seems to be worthy of special comment is the effort made by the Accounting Section of the NELA to bring about national uniformity in accounting methods and practices. To understand the importance of this efort, a survey of the field is here also necessary. Governmental regulation of public utilities has now being the established policy in the United States. Most of this regulation is done by State wide Public Service Commissions, although in some instances the regulation yet remains in the hands of cities and towns. There are 48 states in the Union, almost every one of which has now created a Public Service Commission, and many of these Commissions are authorized by statute to prescribe systems of accounts for the use of the utilities under their respective jurisdictions, and in many States the additional requirement is added that utilities shall keep no records or accounts other than those so prescribed. The Commissions, immediately after their appointment, proceeded to carry out that feature of the law having to do with the preparation of systems and accounts. The plan generally followed was to appoint a certified public accountant or someone in the employ of the State having accounting knowledge to prepare systems of accounts for adoption by the Commissions.

The appointees of the different States did not confer with each other. There was no effort made to see that the different State Systems were uniform in any particular. On the contrary each State appointee seems to have endeavored to impress his individuality on the system he was working upon. The business to be regulated, on the other hand, was uniformly conducted all over the nation. Companies in Maine and California had about the same general conditions, met with the same problems, and before the regulatory era was inaugurated, conducted their affairs on a reasonably uniform basis. In other words, the business was of a character which readily lent itself to standardization of accounting methods and practices.

The result of this different treatment by each of the State Commissions can be imagined. The differences included essentials as well as non-essentials. The form of the balance sheets differed; income statements were prepared on different bases; the very structure of the fixed capital accounts and the distribution among accounts of the expenditures difered, differences in nomenclature were common. So great were these differences between the various jurisdictions that comparisons of operations between one section of the country and another were difficult if not impossible. Holding companies having interests in various States were greatly embarrassed in merging the operations of their different interests into an organized statement.

The situation thus created was a reproach upon the accounting profession, and the Accounting Section of the NELA felt that no effort should be spared to correct this anomalous condition. In proceeding with its effort to establish uniformity in accounting methods and practices, it soon became apparent that to accomplish uniformity by separate appeal to the different State Commissions was a hopeless task. It was fortunate however that the individual Commissioners of the different States had a national organization of their own—"The National Association of Railway and Utilities Commissioners"— and this organization, while of course having no jurisdiction in the various States, its actions in any particular situation nevertheless would have a very strong and persuasive effect. The Accounting Section of the NELA therefore approached the Association of Railway and Utilities Commissions, described the chaotic conditions prevailing so far as uniformity in accounting methods was concerned, and finally succeeded in enlisting the interests of this Association to the point where it appointed a Committee on Accounts of Public Utility Companies, this Committee being instructed to confer with similar bodies appointed by the commercial interests with a view to the adoption of a standard system of accounts. The Commissioners' Committee and the Utilities Committee at once got together. Negotiations and conferences were held over a period of four years, and the final result of all these meetings, conferences, etc., was the adoption by the Association of Railroad and Utility Commissioners at its meeting held in Detroit, November 1922 of a Standard System of Accounts for Public Utilities, both electric and gas, and this System was recommended to the Commissioners of the different States of the Union for adoption. Both the National Electric Light Association and the American Gas Association have adopted the System, and an effort is now being made to bring its advantages to the attention of the various State Commissioners.

Thus the basis for uniformity has been established. The effort to reconcile the divergent views and conflicting opinions of

the conferees was no slight one. The system as finally adopted is the result of the meeting of many minds and necessarily represents compromises of individual opinions. These compromises however are confined to non essentials. I recall the lengthy debate occurring in connection with the determination of whether we should use the term "notes payable" or "bills payable;" whether mortgages and permanent debts should be carried under the caption "funded debt" or "long term debt." Matters of this kind were settled by majority vote. Principles, however, were not compromised. The NELA delegates insisted that a system of accounts should comprise a recital of facts only; that economic opinions and regulatory theories should not influence the arrangement of the data, that the purpose of accounts was to record the history of the enterprise, and that no matter how widely opinions might differ as to the economic significance of the transactions shown in the accounts, these opinions at least should be based upon the same set of facts. This idea very fortunately prevailed. A suggestion that the reserve created out of earnings for the maintenance of the property should appear on the asset side of the balance sheet as a deduction from the amount of the fixed capital account, was vigorously opposed by the NELA people. The topsy turvy, absurd proposition that the financial provision made to maintain the efficiency of the plant necessarily and to a corresponding extent impaired its value, could not be compromised. Again I am happy to say the common sense view prevailed, and in the classification of Accounts as finally adopted, the reserve for the maintenance of the property appeared in its proper place on the liability side of the balance sheet.

The result of these conferences and the effect of the work initiated by the Accounting Section of the NELA to provide a basis for national standardization of accounting methods and practices is indeed an accomplishment. The system of accounts thus created is well adapted to the needs of the industry. As a system, it is sound, safe, and sane, and is a creditable production to all concerned.

CONCLUSION

I conclude now with what I consider the crowning accomplishment of the NELA Accounting Section, i. e., the development and the broadening effect of Association work on the accounting personnel. No longer is the accountant the cloistered occupant of the north east corner of the building recording the actions of others for the use of others. Contact with his fellows, the educational effect of committee work, the acquired ability to stand on his feet in public meetings to present his views and if necessary to defend his methods has stimulated his interest and has broadened his outlook. He has realized the exceptional opportunities afforded by

his position to acquire knowledge of his Company's affairs and the importance of visualizing the work he is recording—a preliminary step to making this knowledge felt in the councils of the Company. A Company executive who is so fortunate as to have on his staff an accounting official of the modern type, his faculties sharpened by Association work, has ever at his elbow a source of authentic information and a seasoned judgment on matters of general company policy upon which he can confidently rely.

PRESIDENT:—I will ask Mr. Munro Grier to extend the thanks of the meeting to Mr. Edwards for his address.

MUNRO GRIER, K. C.:—Mr. Chairman and gentlemen, I am really in a very embarrassing position. I frequently am placed in this position by being asked without any warning whatever to speak upon a subject very dear to my heart, but on which I am absolutely incapable to deal with intelligently at a moment's notice. That is the situation this morning.

I offer a sincere and hearty vote of thanks to the speaker who has just addressed us. As he spoke, I could not help realizing that whilst his dilation upon the point was not at any great length, most unquestionably he made very clear this, that it was not only of the greatest possible use to the Company to have an accountant well versed, but that it was of the greatest possible use to the accountant himself to have a general knowledge of the affairs of his Company. Matters really owe their interest, I think, largely to the way in which they are dealt with. (Applause.)

PRESIDENT:—We are falling far behind our schedule. At the same time we have the opportunity this morning to listen to some other friends attached to the National Accounting Committee, and inasmuch as the photograph has been postponed, I think we can fit them in now. I will ask Mr. W. J. Schmidt, Jr., of the Baltimore Company, to say a few words. Mr. Schmidt is a past President of the National Accounting Section. Mr. Schmidt?

WM. SCHMIDT, JR.:—Mr. Edwards, in his address, has clearly and completely covered the scope of the work of the Accounting Section of the National Electric Light Association; therefore, I will have very little to say. I do want to thank you, however, for kind invitation extended to the Accounting Section to visit you in Canada and participate in the meetings of your Section. I also want to take this opportunity to thank the Chairman of the Canadian Accounting Section for his splendid co-operation. Mr. Little has been with us at many of our meetings and I trust that he will be as faithful in attending meetings in the future as he has been in the past. I had intended to read to you a portion of my report as Chairman of the Accounting Section of the National Electric Light Association, but, as stated before, Mr. Edwards has covered

the subject so well, I will refrain from doing so. I thank you gentlemen. (Applause.)

President: We also have Mr. W. A. Jones, present, the Chairman of the National Accounting Section Commitee. Mr. Jones, will you say a few words?

W. A. Jones: On behalf of the Executive Committees of the Accounting National Section of the N. E. L. A. I want to express my thanks for your invitation to meet with you at your Convention and for the hearty reception which we have received. I also wish to express the hope that you have a successful Convenion and I pledge you the hearty co-operation and help of the Accounting National Section of the Association, in furthering your work.

We feel that the Accounting Section has become a real factor in the work of the Association and we would like to make available to our Canadian friends some of the experience we have gained through many years of hard work. I would especially urge that the chief executives of the Class A members see to it that the accountants of their various organizations are encouraged to take active part in Association work, for I am satisfied that this interest will result in a broader and more thorough understanding of the management's responsibilities. I am also quite sure that an accountant who is alive to the possibilities ahead of him can be of invaluable assistance in the administration of the affairs of the Company. There was a time when the accountant was not so necessary to the successful conduct of the business. That was the time when business organizations were smaller and for the most part one-man affairs. There was a time when the Canadian Pacific Railroad was not necessary to the development of Canada, but that time has long since past. So too with the development and growth of our large electric light and power companies and other industries has come the necessity for the employment of highly trained specialists, among the most important of whom are the trained accountants. To this class of men is passed the responsibility of gathering in an orderly manner operating and financial information so necessary to the proper conduct of a business.

If you executives of electric light and power companies will give to the accountants of your respective organizations the sympathetic interest which they need in the development of their particular accounting methods through the Association, you will find that your efforts will pay good dividends in more intelligent management and more comprehensive reports invaluable to you in handling your work. (applause)

President: We have one other friend with us, Mr. Jenkins, but at the moment I am not going to call on him. He has a special

message outside of the accounting platform, and I want to give him a good chance. We will let him have that opportunity later.

We are running fairly close now, with 20 minutes left before lunch. I think we could well ask the Chairman of the Technical and Commercial Sections to present thesir reports at the beginning of the Commercial and Technical Sessions. They logically come at that point.

We have with us the Accident Prevention Committee Chairman, whose report will be followed by a special paper by Mr. Winter. I would like to proceed with these items on the programme without any further delay.

Before Mr. Winter makes his speech, I notice a lack of advance copies in the hands of our members present. For the purpose of the discussion of our further papers, I would suggest that you get them so that we can proceed intelligently.

Pardon me for interfering with Mr. Winter. You all know Mr. Winter. (Applause.)

ACCIDENT PREVENTION

W. H. WINTER:—We should all be interested in Accident Prevention and in presenting to the Convention a paper on some ideas and ideals used by one of our largest Public Utilities, to keep the staff interested in Accident Prevention, I believe I am justified in taking up your time by the fact that there is still need of greater effort in preventing accidents as it is only a few weeks ago the press in a news dispatch from Ottawa stated that the figures compiled by the Statistics Branch of the Department of Labor of Canada, although admitting that they are not necessarily complete, showed an increase in the number of accidents during the year 1922 over those occurring in the previous year, and it is stated that the highest number of accidents occurred in the transportation and Public Utilities group.

We as members of the C. E. A. and large employers of labor in the Electrical Industry are morally and legally responsible for reducing the hazards of our business to a reasonable minimum and prevent accidents.

Pilate washed his hands of responsibility when the most important incident of his whole life was before him for judgment; but they were not made clean by the process. There are certain stains that cannot be thus removed. There is a mistaken notion that we can escape responsibility by merely not assuming them. We have no choice in the matter. Certain responsibilities belong to us for the prevention of accidents, whether we be the President, General Manager, Superintendent or Foreman, the responsibility remains even if we ask others to assume it. Responsibility is not

lessened by dividing it; nor is it decreased by being delegated. The first requisite of success in Accident Prevention is that the Executives of the organization have a thorough realization that the lives of their fellowmen are at stake and they believe thoroughly in the desirability of attaining a uniform and effective policy in the prevention of accidents or their recurrence by having the plant engineered, built, maintained and inspected to reduce hazards to a minimum, and with the idea of safety in every detail by supplying tools and equipment adequate, properly maintained and of good quality for the needs of the work.

The interest and support of the Executive and Management in Accident Prevention having been obtained, we must consider how we can sell the idea to the first and second line of supervision, which is the big job, and also the men in the organization who suffer the injuries and who should be the most concerned in preventing them.

It is most important to get the idea across to the Supervisory force: the Gang Foreman must be sufficiently interested in Accident Prevention to teach care and carry out safe methods of doing work so as to get the gang to work on the principle that they have not only to protect themselves from accidents, but also their fellow employees and the public from injury.

Even if the staff should reach this condition, further effort must be continuous to keep up interest.

I will try and outline briefly the work and results obtained by the Bell Telephone Company in their efforts to prevent accidents. The Bell Telephone Company has been interested in Safety First and Accident Prevention for a number of years with considerable success at some points.

We carried out the usual scheme of Safety First signs and Bulletins but generally with indifferent results, as we had no particular objective and were not carrying out a universal and intensive course of education. Early in 1921, we learned that some of the American Companies had been able to make an appreciable reduction in their lost time accidents by educational and competitive plans, and the Management decided to investigate, with the result that it was decided to carry out a campaign to Prevent Accidents in our Company.

The first move was conferences with the Supervisory Officials, then personal talks to groups of employees by officials, who could talk their own language in a convincing manner, appealing to them from a humane standpoint, as also from the economic standpoint and assuring them that the President and Management were behind the scheme and wanted their co operation in carrying it to a successful issue, considerable interest was aroused and they

invariably agreed to do their part. After the gang was interested the next problem was how could we keep them interested. With the hearty co-operation by the staff giving suggestions and the co-ordinating and carrying out of ideas we believe we have and are keeping the employees interested.

Of the ideas which have been worked up to increase interest is the awarding of a Bronze Accident Prevention Button to the Foreman in charge of four or more men who for a year is without a lost time accident to himself or his men, if he carries on for a second year, he will receive a gold button and if for three years a pocket book with certificate, and for four years a silver dish suitably inscribed.

The effect of this idea is that the Foreman watches his men and the men under him, if they are loyal, will take a personal pride in his receiving recognition and they will not lay off for trifling accidents.

The length of time required to win recognition by a button necessitated something to stimulate and maintain interest and encourage the staff in their efforts and Banners were designed showing the year and each month, these are issued in the smaller areas, one per area and in the larger areas, one each to cover the various groups of employees, central offices, as also each travelling gang in the Construction Department. For each month without a "lost time" accident, a Gold star is issued, which is to be attached to the Banner opposite the proper month. This has created a great interest, each area or group trying to win the twelve stars for the year when a 100% badge is supplied, this keeps the Accident Prevention idea constantly before them.

With our active Accident Prevention campaign, we early realized that some effort should be made to remove unsafe concerns, or unnecessary hazards and as an effort in this direction, we issued pledge cards for posting up on Bulletin Boards and at other suitable points where they could be read by the employees:

> "I will do all in my power to guard against unsafe acts on my part.
>
> If I see a fellow employee doing his work in an unsafe manner
>
> I will speak to him as a friend, and use my moral influence to have him perform his duties in the safest possible manner.
>
> I will endeavor at all times to PREVENT ACCIDENTS."

Also Forms for reporting and a routine for carrying out their clearing up. (Read section of Routine)

Since July 1922 to May 1st this year, we have received 885 reports of which 628 have been cleared up, of these cases a num-

ber were cleared by Light and Power Systems after their attention had been called to them.

With the co-operation and assistance of the employees, a Safety Code Book is issued to each employee who must be conversant with its contents.

As a further thought to keep Accident Prevention before our employees, we issued early this year a Pocket Piece to each employee to serve as a constant reminder to always think "Is it safe." This was supplied on a card in an envelope with an inscription as follows:—

"Something novel, something new
You will find inside for you."

This idea made a real hit with the employees and has been very favourably commented upon by officials of various Systems throughout the Continent.

Signs on windshields of Motor Vehicles have been largely used but are of little value if it is the same sign all the time, by having a series of various shapes and slogans with a change every two weeks, results can be obtained, as the different shape catches the eye and attracts the attention of the driver, good results have been obtained from this scheme.

We have at some points Employeees Accident Committees who work in conjunction with the Management in the investigation of accidents. Where such Committees are functioning considerable benefit has been obtained by the opportunities offered of impressing on the employees that they are partners in responsibilities which they must share with the Management in preventing accidents.

The pay envelope can also be used to good advantage by stamping attractive slogans in different shapes and colors. a change each pay day is necessary to ensure results.

Charts showing accidents in the various groups, areas, districts and divisions posted monthly for the information of the gang has stirred up considerable interest and competition.

Accident Prevention is good, but it is well to have a secondary defence in First Aid. We organized last year the Bell Telephone Centre of the St. John Ambulance Association and 1,104 employees have taken the First Aid course. We believe that the First Aid instructions will be beneficial in not only teaching the be asked what are the results for all this effort? We obtained re importance of First Aid, but will assist in impressing the importance of avoiding accidents by considering Personal Safety.

As we live in a Commercial age, the question will naturally sults as the following statistics will show based on the number of accident cases per 1,000 employees.

	1921	1922	4 mos. 1923
Cases lasting one day or more	5.5	3.7	2.6
Cases less than one day	1.8	3.1	3.8
Total days if disability	49 46	35.54	
	2 fatal each year		

and the accident disability Benefits and expense charges were reduced from $32,681 to $28,215 or $4,466.00.

It will be noted that the number of minor accidents increased and this we are of the opinion was brought about by the fact that a lost time accident means the loss of a star on the group banner. therefore, employees are more anxious to return to work than lay off after a slight accident, and this has been confirmed by instances which have come to my attention where employees after having an accident have urged the Doctor to permit him to return to work. Employees previously have been inclined to combine a question and statement to the Doctor that I suppose I will be off for a week or two which the Doctor would generally agree to.

We have by no means reached the point where we can say our employees are all educated to the Accident Prevention idea. we still have accidents, many of which are claimed as hard luck. but which I consider should not be classed as such, as they are brought about by thoughtlessness and carlessness.

In the Electrical Systems, a great number of the employees are necessarily out of vision of inspection and, therefore, we must trust to their loyalty to perform their daily tasks, including accident prevention. A system of intensive education is, therefore. necessary to interest the staff in the absolute necessity of employing his time safely and to the best advantage, remember they are human, appeal to them and show them it is for their good and accidents mean lost time and pain for them and suffering for their families.

Figures cannot tell the whole story of Accident Prevention effort. Actual results can never be gauged. It is like throwing a pebble into a pool, you watch the ripples widen till they reach the shore and then they cease, but the shore receives vibrations from these ripples and the vibrations continue on and on till no one can guess where they will cease.

In conclusion success in reaching the goal of Accident Prevention is dependent upon safe construction and maintenance of plant and equipment and safe working methods with workmen educated to make safety a habit of thought and action.

(Applause.)

W. MACLACHLAN:—I would like to call on Mr. Milliken, who has come from Boston as representative of the NELA Accident

Prevention Committee, to enter into discussion Mr. Winter has raised. Mr. Milliken?

E. R. MILLIKEN: Mr. Chairman and members of the Association. I have to confess that I am labouring under various difficulties. Mr. Edgar, whom I am here to represent, called me on the 'phone and asked me to come up and take his place. I got in touch with Mr. MacLachlan to get an inkling of what I would have to speak on. I asked for copy of Mr. Winter's paper, but he never replied. Therefore I am more or less labouring under difficulties.

In spite of that, it is a great pleasure for me to come back to Canada. I feel I am more or less at home up here. I spent quite a few years here, and when I left took a family, including my two children. Therefore it is a pleasure to come back, particularly to Montreal. The last time I was in Montreal it was during the greatest accident prevention campaign in history—in '17.

The question of accident prevention in our industry is just as serious a one as any other, but it seems to be difficult to interest executives in it. Why I do not know. I think in the first place it has been given much the same status as accounting. It has been an abstract matter, most people feeling, "Oh well, we're got so many other things to do, perhaps this will take care of itself." But it isn't so, and it is one of the most important factors in our operation.

The trend today seems to be to consider that human nature has a great deal to do with accidents. Human nature also has a great deal to do with all our operations, particularly on public relations work, which has just started and which is growing very rapidly. Some of the things we do in connection with accident prevention work will help out in our public relations work. I will touch upon that later.

In regard to Mr. Winter's paper, the Bell Telephone Company organization in the United States, and Canada, is looked up to by all the other utilities as blazing the trail in a great many phases of accident prevention work. At every meeting of the National Safety Council, it is the telephone folks who always put something over that is a little ahead of the rest of us. I have in mind one occasion in Boston, two or three years ago, when they showed a film of accident prevention first aid work, in which something like four thousand employees took part. Through that medium and through the medium of our technical press, we all know what they are doing, and in all justice to our own industry we should get a move on and catch up. Some of the companies represented here may have caught the spirit, but in general there is a matter of indifference with regard to accident prevention. Mr. C. B. Scott, Chairman of the NELA Accident Prevention Committee, whom I have had the pleasure of meeting and talking with

on various occasions, feels that keenly, and I think anything that can be done to awaken the executives of our companies to the importance of accident prevention, is well worth it. Why the executives? In the old days we looked to the superintendents' and foremen. Of course the foreman is recognized as the keynote in accident prevention in many of its phases. But to understand accident prevention today is going behind the scenes. Mr. Fisher, formerly of Lockwood Greene & Co., large consulting engineers and manufacturers in New England, has written a book, "Mental causes of Accidents", which was published about a year ago. If I can not do anything more than to bring your attention to that book and get you to read it through, not from the standpoint of accident prevention but, from the standpoint of its doing you a great deal of good and making you think along lines that will help, I should feel I was well repaid for coming here. The book is excellent from start to finish.

Someone has said that failure to study human nature has wrecked empires and the railroads. We all admit in our country that the railroads have been pretty nearly wrecked. I would like to paraphrase that and say that failure to study human nature has resulted in a great many accidents. Back of all our movements, and of our accidents, failure to study human nature has shown through our omissions, and the wrecks which are the results of those omissions. At the NELA Public Relations Section meeting in New York two weeks ago, Mr. W. D. B. Ainey, of the Pennsylvania Public Service Commission, made this apt remark, and it applies to accident prevention and public relations work as well.

> "You know there are those who think that the great problems of life are ones that can be solved from the standpoint of the logician. Never was a greater mistake made. The emotional characteristics of mankind are the factors which in final analysis control his life and control the nation. It is not cold logic by which men judge either social, economic, or political affairs; but it is those other things that when rightly related make up the finer sensibilities and expression of man. The inter-relationship that comes between two men who have established a friendly handshaking acquaintance brings them to a conclusion that no amount of controversy on printed page would ever bring."

You can apply that to accident prevention work, and Mr. Fisher, in his book, plays upon that phase of accident prevention work very strongly. He states that accidents which used to be attributed to carelessness have back of them something in the man's mind that he is thinking of—financial worries or that he is physically unfit, and these tend to take his mind off his job. If any of you have been in financial difficulties, you know what effect it has on

your whole being, and what the effect is on your daily work. We have probably hundreds and thousands of men collectively who have some trouble, financial, physical or otherwise, which is a cause for worry, and leaves them more susceptible of doing things which result in accidents.

Bearing out this fact, that accident prevention now consists not alone in the material things which we have done in placing safe guards on machinery, and issuing of rules, etc., it is a fact that the United States Steel Corporation in recent years found 45% of their accidents occurred in hand labour — through men falling and men dropping things. You cannot get at that through safe guards.

The only way to approach the man is through his mental condition. Get him so he is on the job mentally and not somewhere far away. I think those figures will show the importance of that particular thing. If we do not do this we are going to be much like the doctor who performed an operation in a hospital. Fire broke out next door when the patient was just coming out of the ether. The doctor went over and pulled down the blind. The nurse asked him why he did that. "Well," replied the doctor, "I don't want the patient to think the operation was unsuccessful." We don't want to carry on our operations fairly successfully from the standpoint of service and dividends, and then find that from the standpoint of safety and continued welfare of our employees, or the public, that the operation has not been successful. There is only one way to do it — get at accident prevention work. In the work of the National Safety Council there is a great deal in which our industry should become interested in. Accident prevention to us should not consist solely of work amongst our own employees or the preventing of accidents to the public from our operations. Accident prevention work opens up one of the greatest possible fields for improving public relations. Consider just for a moment the position which you can place yourselves in in a community through the support of general accident prevention work in that community, through local safety councils or committees on safety of that kind. Can you become identified in any one thing which would bring you into closer contact with all the elements of the community in any more favourable light? There you are in the light of preventing suffering and saving lives. Can you through any other agency become better placed in the community to help humanity as we are doing?

The results are immediate, and if you help that thing along, and through your efforts you have done something which has helped to save the life of some citizen, or particularly of his children, it puts you in a very favourable light. I do not think we have fully and sufficiently recognized that accident prevention is a most im-

portant branch of our public relation work and it should not be overlooked.

That goes further — getting accident prevention propaganda (if you wish to call it so) into the schools. We want to get children educated to the fact that falling wires are dangerous, and we cannot do that half as well through the medium of some of our officials going in to talk to the children. But if we can bring it about through the agency of the local Safety Council, it can be done, and we can accomplish what we want, without any suggestion of commercialism or selfishness entering into it.

There are a lot of people who are still skeptical about accident prevention, and as to the need of it, but looked at from an economic standpoint, we all know that the lineman is becoming more or less an extinct species. I mean by that that years ago in the early days of the electrical industry, if a man was a lineman, maybe his son thought he might be a lineman too, and in the same way miners' sons used to want to be miners too, but they don't want to now, and shortly we will find there will be a shortage of lineman. Just in a plain dollars and cents standpoint, if there are going to be difficulties in securing linemen, we should do everything possible, regardless of other humanitarian interests involved, to do all we can in our local organizations to protect the men we have, who are becoming ever increasingly difficult to replace. The thing wants to be looked at from both angles — the economic and humanitarian standpoints. It wants to be looked up and down like the little Hebrew boy, who approached his father with the request: "Fadder, will you lend me $100? "Why, Ikey, what do yuh want $100 for?" "Well, you see I want $100 to go into business." "Well, I'll lend you $100, but I will charge you interest." "Fadder, what interest will you charge?" "Well," said the father, "I'll charge you 9% interest.." "Why, fadder, what would Father Abraham think when he looked down from heaven and saw you had charged your son 9% ? "Well, Ikey, never mind, when Father Abraham looks down from heaven, the 9 will be a 6." (Laughter.)

We want to be certain we look at things from every possible angle and get behind the committees of our various associations, and our educational committees as well, in this way; and we don't want to make all 6s 9s, and all 9s 6s. We want to make them just what they are. In reality it is welfare work from the economic, humanitarian and public relations standpoints. (Applause).

PRESIDENT:—I am sure we are very much indebted to Mr. Winter, of the Bell Telephone Company, Mr. Millikan, and Mr. Edgar through him, for the papers and addresses we have received.

I want to thank everybody for their very careful attention today. (Adjournment to lunch).

THURSDAY LUNCHEON

PRESIDENT:—Ladies and gentlemen, it is with great pleasure that I welcome you all here today. Inasmuch as I am not quite sure of the acoustic properties of this hall I would be glad to be advised, for the benefit of the succeeding speaker, as to whether my voice is clear at the end of the hall. (Loud and agonizing cries of "No.")

I can only say I am very sorry for you.

C. JOHNSTONE:—Get a broadcasting machine.

PRESIDENT:—Thank you, Mr. Johnstone.

We have a very good speaker with us today, so I will not take up very much of your time, except to officially welcome the ladies here at this, the first of our functions. We trust that they will be with us right through, not only at the luncheons, and the dinner, but to stay tonight to the dance, and if possible to bring some lady friends with them, because it looks as if we may be a little short of ladies tonight for our dance, and as all these good-looking boys here are adepts at the various steps of the tango a la Rudolph Valentino, I am sure the young ladies who come will be well taken care of from that point of view.

I have a few notices which I am going to read:

The photograph will be taken immediately after this luncheon, at the main entrance. We would like to have this photograph representative, and would be glad if everybody will make it a point to immediately proceed from this meeting to Peel Street, and assemble out there as directed by the photographer.

The ladies are to meet in room 1084 immediately after the photograph has been taken.

Members desiring to enter the golf tournament, must purchase their tickets from the Ticket Clerk today, or notify a member of the Entertainment Committee. The train for the golf tournament will leave 8.30 daylight saving time, Saturday morning, from Windsor Street, C. P. R. Station.

The Entertainment Committee have asked me to ask the Montreal members particularly to bring their wives or lady friends, or both, to the banquet tonight.

The automobiles for the drive for the ladies to Chenneville tomorrow will leave immediately after the luncheon.

Well, gentlemen, those are all the notices I have, and I am about to introduce to you the speaker who is on the programme, but was not upon our original programme. We are very much indebted to Mr. Feiker for coming to us at such short notice. The original programme called for the President of the N.E.L.A., our friend Mr. Walter H. Johnson, but unfortunately he could not make the trip until tomorrow, so we had to put him on tomorrow.

but Mr. Feiker kindly came at a moment's notice, to deliver a message. I think when you have heard him you will find we have not suffered any through the change. Mr. Feiker tells me he has a few stories, and I think perhaps I might repeat one story which I heard in New York, which probably has not got up here yet. This is in connection with a local town council, upon which there was a certain amount, as usual, of, I might say, antagonism between various factions. The job of treasurer became vacant. There were two people anxious to get it — one a very good Irishman, the other a very good Jew. There was a good deal of canvassing, of course, and finally the Irishman got the job. In due course, owing to prudent administration, of the Irishman, quite a lot of funds were available, so one evening the town council sat down to discuss the disbursement of these funds. The Irishman, always remembering the antagonism that had prevailed previous to the election said: "Gentlemen, to my mind we ought to have a dinner. We should have a good pork dinner. We should have pork cutlets, sausages, ham, roast pork, and boiled pork. We ought to have a really good blowout with our friend, the pig." The motion was put to the council and carried through, without any objections. The Jew then got up and said: "Well, gentlemen, I have no objections at all to my Irish friend having a pork dinner, but I must insist that it be held on a Friday." (laughter). Co-operation in the true sense.

Well, gentlemen, I won't burden you any more with words of mine, and will call upon the speaker today, Mr. E. M. Feiker, who quite recently became associated with the Society for Electrical Development, well known to all of us. This is quite recent so we cannot judge him by such a connection. He was for eight years Vice-President of the McGraw Hill Company—the large publishing house in New York. More recently he was Assistant to the Secretary of Commerce, of the United States, our well-known friend, Herbert Hoover.

Gentlemen, I have much pleasure in introducing Mr. F. M. Feiker.

F. M. FEIKER:—Mr. President, ladies and gentlemen, when your President said I was going to tell you stories, he reminded me of that riddle: What is the difference between a Scotchman and a cocoanut? the answer being that you can get a drink out of a cocoanut. It is about the same way with me in regard to story telling. I am in the same class as the Scotchman.

When I came in, your President asked me if I had anything serious to say. I said "Yes." He looked so worried, that I immediately went through my little black book to find all the stories I ever heard, thinking perhaps that would help to make the luncheon a success. I read the other day in one of the New York pa-

pers, about a small boy who had been in a high school orchestra for four years, and had heard all the commencement speeches. Some one asked him how he enjoyed Commencement this last year. He said, "Oh, it was like all the others — they all knew when to commence, but none knew when to stop." (laughter) I assure you that so far as I am concerned, I am going to speak about that well known subject, "Twenty Minutes."

I was also reminded by your President's introduction in which he placed me with various titles as a speaker, of that old story that came from California, about the original of the word "Realtor" I always think of that story when I am introduced with a background of titles. The word was coined to give a fitting professional title to real estate operation. It comes from two Spanish words — real, royal and toro, meaning bull. (laughter)

It would be very hard for an electric man to come to your City without feeling immediately at home. Although this is my first visit to Montreal, and the first time I have stood before this particular Association, as electrical men we have something in common to talk about, and the serious part of what I have to say has to do with some of those conditions that we have in common.

I suppose that all the orators of the day, when they get up to speak about the world and the relation of their particular part in it, start out by saying that the world today is a very different place from what it was ten or twelve years ago. The complexities of living that have developed during the last hundred years in both our countries have brought some very definite and serious problems to our industry, along with every other industry. These complexities have grown up in spite of ourselves. One American recently made a rather remarkable survey of the rising cost of agricultural products as delivered at the farm. He told this story. He said it cost him more now to park his hat in the average hotel than it used to cost his family for the week's supply of milk. That is a fact, but you cannot pin anything on anybody for that. Our civilization today has grown so complex, and we are all part of such a huge machine, that everyone has a few more motions to go through to arrive at the same final result we arrived at several hundred years ago and every time we add a motion we add an item of cost.

We all know how intimately the electrical industry is associated with all phases of industry today. You and I all know it, because we are in the electrical business, yet the average person is so closely associated with the electrical industry, that sometimes he does not realize how much his very life depends upon it In my own personal case, in the morning (and of course I have an electric home) I suppose my breakfast is completely cooked electrically. I get into an electric car and ride to the station. I go

to the City of New York from my suburb in an electric train. I ride on the subways. I have all the other advantages—light, telephone, and all those conveniences that constantly add to the complexity of furnishing me with the necessities of life.

That complexity has brought with it two or three big problems, one of them the rising costs that bother us, whether on your side of the line or on ours. Two or three fundamental things are at the bottom of those rising costs. One of them is that we are struggling under tremendous tax burdens. It is estimated that in the states at least 12 billions of dollars are paid in Federal and Municipal taxes alone, which means that extra amount of wealth has to be taken out of production and applied to costs. Many of our social and political problems all seem to revolve around the old question of supply and demand. We also, both in Canada and the United States, desire that our children should be brought up under better conditions than we ourselves were. In this country of America we expect the standard of living to be a rising curve and not a flat curve, and so as we look ahead we can see luxuries becoming necessities. So we are going to find as the years go by not decreasing costs but increasing costs. Those things are some of the serious problems facing us for solution as men in the industry.

When I was in Washington at the Department of Commerce, as assistant to Mr. Hoover, the first job I had was to try to assemble some of the programes that might be put to work to help meet these conditions in the United States. Without going into detail about that work, because there is no time, I want to eliminate a large part of the things I expected to say today, and put the answer in a word. It seemed to be found in two broad directions: First, the steps that men as individuals may take in working out problems to come; the second, the steps that we might take as groups of individuals in meeting problems collectively.

Your Chairman introduced the subject of co-operation and collective action, which reminds me of another Scotch story. The townspeople in one of our small American towns met one evening to discuss plans of raising a large sum of money for a Y. M. C. A. drive.

As you know, it is the regular scheme to have tables like this, with a bunch of wax works like this at the head table. The ladies sit out in the room as you are today. The Chairman gets up and makes a wonderful speech (something like mine). The town is divided into sections, each table being given a certain part of the town to canvass, and then everybody jumps up and sings "God Save the King."

But the President had another thought. He rose to his feet and announced: "As a commencement to our drive, we want to

raise $15,000 before we leave the room. As soon as the meaning of it had sunk in, a little Hebrew up in the front row fainted (Pause) Two Scotchmen came down and carried him out.

(Laughter.)

The little Jew's action was individual, the Scotchmen's action was co operative.

Two broad facts stand out in this study of collective action. One is that it is a very simple matter to decide to have collective action, and it is a very simple matter to have someone make speeches about something or other, but it is another thing to put action into effect in industry. The problem facing business men is not only to appreciate their opportunity for collective action in industry, but to carrying it through it is necessary to have some machinery to put collective action into effect.

We all know what a tremendous amount of material is filed away every year in committee reports. I do not know of another industry, and I say this after a study I have made of other industries, that is organized as thoroughly as the electrical industry — where the men come together with as much enthusiasm. I feel that particularly after sitting through a week of the N. E. L. A. meetings in New York, where four or five hundred men sat in their shirt sleeves in torrid heat and discussed intimate problems of the electrical business. It was a fine exhibition of the desire of men to discuss their common problems together. Yet I had the feeling after that wonderful meeting was over, that machinery was necessary to carry those ideals into action and practice.

Now, I am slated as a member of the Society for Electrical Development. I have not time to talk about that in detail, except to show why I see its relation to the broad activities of the industry through organization in the sense I have suggested. The Society as it is now constituted is carrying through certain definite programmes which are part of the collective work of the industry as a whole. It can help you put electric homes, promote lighting and wiring campaigns, develop the electric range business, promote electric trucks.

Other broad phases of the need for collective action is found in the application of national ideas to the local community. I think the great need today is to stop talking and to put these national ideas to work in the local communities. That is our next step forward, and in that particular I was interested in the discussion this morning that took place on the question of customer ownership. This has great possibilities as central station policy, and should be applied locally in terms of location conditions as a method of meeting the public relations and financing problems as we see them today.

I never hear co operation talked without recalling that the

average man thinks that co-operation means that five men get together to carry the same load that one man carried. I remember a story I saw in one of the New York papers, in which a warehouse in central New York had been robbed by bees. There was a small hole in the roof of the warehouse. Between the time the honey was stored and the discovery of the robbery, three tons of honey had been carried away by the bees, getting through a small hole. The difference between the load one bee can carry and three tons of honey is the difference between co-operative collective action and individual action. Usually bees and ants are the only ones that have discovered that fundamental fact. They are not going to all carry the same load. They all get together and carry a bigger load.

We in the electrical industry are having to face a bigger load, and for the members association activity and collective action in these various matters is a very real opportunity today. Within the last few weeks I have heard the President of one of the biggest manufacturing companies say they expected their business would double in the next seven years. Mr. Hoover in a recent talk and address on general business conditions, has said that what we need to meet these problems of industry that are facing us today is by increasing production. That is the only answer.

I see in the electrical industry necessity for more production. I see also in the electrical industry an organized group of men, not only organized for business, but I like to think there is something that holds us together as electrical men even bigger than the profit that is in the business. I am always reminded, as I make a talk like this, of Wells' History. Mr. Wells, with his remarkable ability of putting down the history of the world in a volume, puts two thousand years in a paragraph. He starts with the slime of the sea shore and concludes with the World War. I read that book and said: "What will America" (and I think of Canadians as Americans, because I think we think in the same terms of our business expansion), "What will America's paragraph be two thousand years from now when another Wells writes the history of the world? It seems to me, and always has seemed to me, that just as Rome left its impression in war, Greece in beauty, this great country of ours is going to make its contribution in commerce—but the only way is through organization, and through a collective understanding of the problems of business. In the electrical industry organizations we have a tremendous opportunity for that kind of ideal, besides the opportunity of making money. (applause)

PRESIDENT:—I will ask our Vice-President, Mr. Beaumont, to extend the thanks of the meeting to Mr. Feiker for his address.

R. J. BEAUMONT:—In rising to propose a vote of thanks to Mr. Feiker, I would like to call the attention of our members to,

and remind some of them of the association work that has been going on recently. I have in mind particularly the work of the Co-operative Association. Perhaps to give an instance of the result of association work, the most important result has been the licensing of contractors and journey men. This means, or is taken to show, that we are going to have, very shortly, better wired homes, and better work, and more conveniences to the public. The result to the contractor dealer is that he has in sight the probability of getting a little more than just a bare living.

Mr. Feiker's speech seems to my mind to give many constructive ideas we might well adopt, and I would add one more word with regard to the association work, and that is we need the help of every one, even the smallest contractor dealer — without that we cannot get very far.

Concluding I wish to propose that a hearty vote of thanks be given to Mr. Feiker for his able, humorous and instructive speech. (Applause).

THURSDAY AFTERNOON — TECHNICAL SESSION

President: Gentlemen, I have much pleasure in calling this meeting to order, and inasmuch as I was spoken to after this morning's meeting about the trouble many speakers had in being heard because of conversation going on, and also trouble some of the members in the audience had of listening because of the same question, I would ask you to be as kind as you can in carrying on incidental conversations. Make it as quiet as possible, if absolutely necessary, or, preferably, retire to the back of the hall to carry on in that way. It is rather hard luck on the speaker to lose attention of the people he is addressing.

The first item is the one we carried over from this morning's session — report of the Technical Section, by Mr. R. J. Beaumont.

The first item on our programme is the report of the Electrical Apparatus Committee, which Professor Christie, of McGill University, is presenting in the absence of Mr. Morse. This report, you will find, is the first report published in the Advance Proceedings.

Professor Christie?

Prof. Christie:—Mr. Chairman, I am sorry that Mr. Morse is not here to present this report himself.

(See report in Advance Proceedings). (Applause)

President:—Gentlemen, I think your Committee is to be very much congratulated upon the very excellent report. I hope you have all read it, but I am afraid perhaps you have not, some of you. It certainly is a very valuable, up-to-date report, deal

ing only with essentials. I do not see an extra word in it that could possibly be cut out.

The main thing at these meetings, however, is to develop discussion, and I think Mr. Christie is the only member of the Committee present who will be able to answer any questions that come up. I would ask you to develop useful discussion on this subject without delay.

In the meantime I have some extra copies here of the Advance Proceedings for the use of those who have come without theirs.

E. Holder: I would like to mention the New Relay Handbook which is being brought out by the N. E. L. A. and American Institute of Electrical Engineers. I have a few copies of a descriptive pamphlet and will be glad to furnish anyone interested in the subject with them. The handbook will cover the matter in a very thorough manner, and will be a very valuable addition to your technical library.

President:—When discussing any subjects, I would be glad if you would mention your name and company affiliation, so that our secretary will not have to ask me the name every time. Get up and say, I am Mr. John Murphy, of Ottawa.

John Murphy: That's my name. Might I ask the Committee if they have any information concerning the lightning arrester which, if my memory serves me, was praised by Mr. Roper of the Commonwealth Edison Co. of Chicago, at the Mid-Winter Convention of the American Institute of Electrical Engineers?

It is the Autovalve Lightning arrester made by the Westinghouse Company.

Prof. Christie: I am afraid I cannot answer that question. I was not in close enough touch with the Committee in the preparation of this report.

President: Have we anybody else present who could answer Mr. Murphy's query?

Evidently we are all behind hand.

That is a regrettable thing. Mr. Roper stated, if my memory serves me, that the experience of the Chicago Commonwealth Company with that particular arrester was much more satisfactory, if I am not mistaken, than any other arrester on the market. We will delegate it to the incoming Committee.

There are valuable things in this report that call for discussion. Is there any question not covered in the report? Don't be afraid to ask questions. These meetings are for the one and sole benefit of all of us. That is to say, if anybody has any question that has been worrying him that comes within the scope of electrical apparatus, now is the time to ask it. Ignorance is no

sin, but ignorance when you have the opportunity to correct it becomes almost a sin.

W. MACLACHLAN:—I would like to draw the attention of the meeting to one point not referred to in the report, but which was emphasized very much in New York — the coming use more and more of the truck type switches in substations. Where you have an important substation with fairly crowded conditions, you can mount your switch, potential and current transformers and small wiring on a regular truck, if anything goes wrong with it, and have it replaced by a spare. All your work is then done in the shop, clear of any chance of any adjoining oil switch going up. I had the pleasure of going through the 7th Street sub. of the United Electric Company. They are going in more for that type. I think anybody in charge, particularly in crowded conditions, would be well advised to look into this type of switch, which was originally designed in England some years ago and was brought over to this country, where it is becoming a real necessity in crowded conditions today.

PRESIDENT:—Thank you, Mr. Maclachlan.

A. A. DION:—While the truck type has indeed merit, it came out in discussion in New York if I remember rightly that the truck switch as developed in America was not the best type. That was the opinion of a couple of British engineers who were present. Their claim was that in trying to save space the American construction was not safe, inasmuch as the oil circuit breaker was crowded in with the other elements in a small space. In England it had been developed along somewhat different lines, where the circuit breaker itself was separate, taken out of the case and mounted behind, where, if anything happened, it wouldn't destroy the whole thing and tie up the switch board.

PRESIDENT:—Mr. Kaelin, have you anything to say on this report? Mr. Gregory, have you anything pertinent to say?

R. J. BEAUMONT:—I would like to ask Mr. Maclachlan, particularly in connection with his Insurance Committee, if he has any record of generating stations in Canada with this new type of protective fire equipment that the American insurance companies have recommended. I believe there are one or two.

W. MACLACHLAN:—They have some protection of that type at the Falls, but very little has been done — that is, using water as protection. You don't refer to the carbon di-oxide? It is contemplated to use that at the Falls, although the idea was to arrange for your air supply to be cut right off at the time of a fire and supply carbon di-oxide, and in that way cut out your oxygen from the atmosphere getting close to your generator. But in putting in any of those you want to watch and have valve properly

equipped and quickly opening, as somebody might open it at the wrong time and flood the generator with water.

President: I was very interested in New York in Mr. Stone's paper on substations. As we have automatic subs referred to here, I think it might be interesting to hear a few of the things Mr. Stone said. He advised us that the General Electric Company in their laboratory in Schenectady had now manufactured vacuum tubes up to 1,000 KW capacity. These tubes can now be so used that not only will they change alternating current to direct current, but operate in the reverse way. They are able to derive one, two, three or six phase alternating current at any frequency from direct current. Mr. Stone therefore predicted that there will be no such things as sub-stations in the future — that we would have high tension direct current transmission systems with a valve on the pole to step down to 2,200 three phase 60 cycle alternating current for distribution.

My vision of the future of distribution is that we will have the 2,200 or perhaps 4,000 system into each customer's premises, by means of a lead covered single conductor cable, the lead being the common ground. Customer will furnish his own transformer and regulating device up on it, so that he can control his own voltage. We will sell in bulk at 2,200 to each customer, and allow him to make whatever use he likes of the service. I believe that with this sort of service at a fair rate, we will be able to work up heavy connections on our system to a point where we may expect at least $100 per annum revenue. We may have to give very many more KWHs than we do today, but as everybody who has studied the question knows, our energy charges are not a very critical factor in the cost of service to householders, the critical factor being the interest on the large investment which is required for distribution. (Applause)

We would like to get some more discussion.

J. H. Trimingham: I would like to know if anyone present has had experience with oxide film arresters on repeated discharges. The oxide film arrester is said to compare favourably with aluminum cell arresters for one discharge, but I would like to know about its performance on repeated discharges.

A. A. Dion:—No experiences in Ottawa.

Prof. Christie: None in Shawinigan.

I would be glad if it would be produced.

for their excellent work. Is that your wish? (Applause)

Now, gentlemen, if there is no more discussion, I move the adoption of this report, and a vote of thanks to the Committee

President:—I am afraid, Mr. Trimingham, we cannot give you any information. If there is any information in the room.

The next report we have unfortunately has been misprinted The title is "Industrial Co-ordination", but that is not the subject of the paper. The paper is on "Inductive Co-ordination", which is the new name for that old subject, interference. This is becoming daily a larger problem, even in our own neck of the woods, the Province of Quebec. We are up against the question of inductive interference all the time now. Whenever we want to build a line we find telephone lines along the highway that blocks us.

This Committee has done excellent work this year, and I have much pleasure in calling on Mr. Trimingham to review the work. (Applause)

(See Report in Advance Proceedings.)

J. H. TRIMINGHAM:—The name of this Committee was changed at the end of last year from Inductive Interference to Inductive Co-ordination, as it was thought that the latter name was more appropriate.

This report deals briefly with the case (probably the largest one of this kind on the American Continent) between the Shawinigan Water & Power Company and the Canadian National Railways. The respective lines were in close proximity, but no trouble was experienced until the railway company decided to substitute telephone dispatching for the previously existing telegraph dispatching. When this had been done, considerable trouble was experienced owing to the fact that the frequency of the induced currents in the dispatching circuit was of course very close to the voice frequencies in use.

The Shawinigan Company, in conjunction with the Bell Telephone Company's engineers, and the Electrical Department of McGill University, undertook exhaustive tests with oscillograph. From these tests it was decided to install an amplifier and loud speaking set in the place of the head set from which the train dispatcher was getting very severe shocks. This has given satis-

faction to all parties. I believe it was claimed that particularly bad noises were caused in the telephone circuit due to the fact that the circuit breakers of the power company were not opening each phase at precisely the same instant.

On looking at Oscillogram No. 1 it will be seen that the surges set up in the circuit when the breaker is open (even after the circuit breaker had been very carefully adjusted) are not absolutely in time phase.

Oscillogram No. 2, which we had to put on another sheet, shows the voltage induced to ground on the opening of the circuit breaker. This is the most severe condition that we have, and even if you had the telephone line separated at a very great distance from the power line, it would be difficult to avoid some induction from opening a line of this nature.

Oscillogram No. 3 shows exactly the same condition when the circuit breaker is closed.

Oscillogram No. 4 shows the voltage induced to ground on telephone circuit when there is normal operation. It can be seen there is nothing there which will cause any trouble. When the two parts of the Shawinigan System were in parallel there was a slight-hum in the telephone circuit, and when they were operating out of parallel, there was a slight beat heard, much like two tuning forks slightly out of synchronism.

We have been trying to go on the principle that an ounce of prevention is worth a pound of cure, and it is our experience that if a real effort is made by the Company — whether the power company or telephone company — to get in touch with the other interested parties before new construction is attempted, nearly all of the trouble caused from interference may be anticipated and done away with. I have been out once or twice with Mr. Lariviere, of the Quebec Public Service Commission, and tried to locate a line as far as possible so as to avoid trouble, and we found that in a majority of instances much of the trouble caused the power company is from the small telephone interests, which are not organized in a way to help out the power company.

We have not tried to recommend the adoption of any set series of rules, because we feel that this work is being done under much more advantageous circumstances in America, where they have a very large Inductive Co-ordination Committee, with about 35 members, with retained consulting engineers to advise them. They are making a very exhaustive study of the whole situation, and we hope that when that is done we will be able to profit thereby, and at the same time get a uniform series of rules for every Province in Canada.

I think that is all I have to say, Mr. Chairman.

(Applause)

R. J. BEAUMONT (In Chair):—The paper is now open for discussion, and members who have questions to ask, we will be very glad to hear from them. It would be interesting, perhaps, to some of the members to hear from other members as to their experience with such things as building lines parallel to the telephone companies' lines. I mean today in the Province of Quebec, before we build a line in a rural district, we have to make an application cussion results. If there is any member who has an interesting before the Public Service Commission, and sometimes a little discussion results. If there is any member who has an interesting experience to tell us in connection with his negotiations with a telephone company or municipalities, I believe we would find it very interesting.

There is another point, too, that is worthy of consideration, and sometimes this is an experience we meet with, of a little telephone company, with no finances and just about existing, going along in a very precarious way, that will, when the power company decides to build a line, make claims for compensation for all kinds of troubles that are supposed to have been caused by the power company. It would be interesting to hear from any member as to what discussions they have, if any, and what has resulted — this is, if they have ever been compelled to pay part of the cost of the improvements or changes that have been necessary to the telephone circuits.

We do not seem to be getting very well along with the discussion on this subject. I know it is perhaps to a certain extent somewhat new, and it is also involved, and so far as the work of the Committee goes, they have only been working for two years, and the work has not reached, as Mr. Trimingham says, very much of a standardized method of treating the different divisions that arise, but if there is anyone here who can give us some expression of some kind, we would very much appreciate it, because Mr. Trimingham's Committee is doing important work that is going to be available to all the Companies, and I think we might almost ask such of you as can help us, to do so, because without your co-operation we cannot get very far. I would like to impress upon you very emphatically the work of the Committee is going to have very beneficial results to the power companies and to the telephone companies. Incidentally I would like to remark here upon the hearty co-operation and help we received, and all the power companies have received, from the Bell Telephone. At times it seems as though the Bell Telephone Company were working harder for the power company than the power companies were working for themselves.

I would ask you again for someone to tell of some little experiences, so that this paper could be adopted at any rate with some discussion.

P. S. Gregory: "I had a small connection with the case which Mr. Trimingham refers to. At first it seemed a very serious problem to solve but when the Engineers of the Companies got together and it was once decided that it was not a legal question but an engineering problem, the difficulties were all overcome and a satisfactory remedy applied in a short time. Just so long as the problem of "Inductive Co-ordination" is considered in its true light, that is, as an engineering problem, there will be no insurmountable difficulties to be met with in its solution, but the remedy will always lie with the engineers and not with the lawyers."

John Murphy:—May I say a word more? I happen to be the individual who was responsible for taking this famous case out of the hands of the lawyers and putting it into the hands of the engineers; that must be my excuse for speaking to you now.

I am with the Board of Railway Commissioners for Canada. That Board suddenly received a telegram from the Canadian National Telegraphs' Solicitor, to the effect that the train dispatcher in the Lagauchetiere station, Montreal, had been knocked unconscious by an acoustic shock; and that that was not the first "trouble" which had occurred on their train dispatching lines. They blamed on the Shawinigan Company, and they appealed to the Board of Railway Commissioners to tackle them and get a promise that it would never happen again — whatever it was! Two representatives of the Shawinigan Company rushed to Ottawa as the result of an appeal by telegram. The representatives of the Shawinigan Company and of the C. N. Telegraph's were directed by the Board to discuss the matter with your humble servant. We got together in a friendly way, and the Shawinigan Company said it had no record of any accidents whatever, or anything unusual, on the date when the train dispatcher was knocked unconscious. The summons by telegraph to appear at Ottawa was the first word the officials of the Shawinigan Company had of anything being wrong. At my suggestions the officials of both organizations returned to Montreal and examined the log sheets of the Shawinigan Company — the log sheets in question being generously handed out to the Telegraph Company representatives just as if they were all working for the Shawinigan Company, a beautiful sign of co-operation, in my own opinion. After a good deal of investigation it was discovered that at the moment the train dispatcher was knocked unconscious, a high tension switch had been opened at Shawinigan Falls — 95 miles away. The Bell Telephone Company's expert, sat in at this meeting, and I would like to pay a tribute to that company as well as the officials of the Shawinigan Company, for the manner in which they went into this whole matter. The immediate solution

of the difficulty was, as Mr. Trimingham said, to take the "head set" off the dispatcher, and put in a loud speaking set, which enabled him to get his messages without fear. The work of the Committee included the making of these oscillograms; and, so far as I know, the legal end of the question has never been brought up again. The Board of Railway Commissioners have never heard another word about this matter again, and the officials of the three companies — the power company, telegraph company and the telephone company, the members of the Committee, as I understand it, have been working in the utmost harmony, just as if employed by a single individual. I feel I would like to pay this tribute to the officials of the three companies on their methods of co-operation, at this opportunity. (Applause)

R. J. BEAUMONT: I wish to thank Mr. Murphy very much for his remarks. If there are any members of the Bell Telephone Company present, we would very much like to hear if they have anything to say on this subject.

Any more discussion, gentlemen?

This apparently closes the discussion, and if it is your wish I will move the adoption of this report, and shall be glad if you will signify in the usual manner. (Applause)

The next item on the programme for the afternoon is the report of the Meter Committee, and shall be glad to hear from Mr. Holder. (Applause)

(See Report in Advance Proceedings)

E. HOLDER: In presenting this report, of which advance copies have been distributed, I would like to briefly go over a few of the subjects not entering into them fully because you will have an opportunity of reading the report itself. We ask for assistance to enable us to make ourselves of use to you. We would like you to bring your meter problems to us. We represent an important branch of the industry. We have on our Committee a large number of manufacturers' representatives and feel ourselves well organized to take up the problems of meter users with the manufacturers and obtain the co-operation which we have heard so much about.

The next subject in our report is the maintenance of meter accuracy, and we publish a table of tests results. This shows a number of results spread over a long period, and we have only one case in this table, of somewhere about 15,000 meters, of a meter over 10 per cent fast. The majority are accurate; and a few are slow, after they have been in service for the seal period and longer. The record of meters which have been in service a very short time show up quite a number inaccurate compared with those which have been in service for a long time. This emphasizes what we have been trying to press home, that we must try

to handle meters more carefully. If we have to bring in meters for sealing, we must try to handle them very carefully, otherwise they will be damaged, and damaged a great deal more than by leaving in service.

I would also like to draw your attention to section of report on handling of meters from the point of view of the manufacturer. He has in many cases been dealt with a little unfairly. We recommend that meters, when received, especially if sent by rail, should be at least inspected before presenting to be sealed, otherwise you may put yourselves to unnecessary expense.

Regarding meter specification. This matter is being handled by a section of the Canadian Engineering Standards Association, who are holding another meeting tomorrow, and hope to be able to publish a specification shortly. Good work in the line of new developments has been done by this section. Most meters are now being produced along standard lines, and credit is due to the manufacturers in meeting the wishes of meter users. Another case of co-operation.

We briefly touch on the question of checking polyphase meter connections. Last year it was brought up that the wrong connection of polyphase meters was still the subject of most inaccuracies. We have outlined a few methods of checking up to find if polyphase meters are correctly connected.

We report on the subject of instrument transformers, to assure our members that most transformers being sold for the purpose are an accurate part of their metering equipment. The question has been raised as to whether instrument transformers are not introducing inaccuracies. If care is taken in selection and use of transformers no large errors will be met with.

We report on the question of measurement of power factor and maximum demand. This is a big subject with our commercial friends. They have asked for instruments which will give them readings upon which to base their bills so as to correctly charge the customer when he is using his load at a low power factor. We list the different types of instruments being produced, and suggest ways they can be used to give you the reading you want. We also suggested to the Power Sales Committee, clauses which you should put in your contracts, — or which we think you should, to take care of these particular points — that is, power factor and maximum demand.

We considered the question of reading of demand meters. This is an important subject. The increasing use of indicating demand meters requires a system of retaining a record of their indication. If you have them reset, then the record is destroyed. We have outlined two schemes in use by which a permanent record can be obtained.

We asked the manufacturers to tell us something about the manufacture of meters. One of the manufacturers kindly prepared a short description of the method they use in making up meter magnets.

You will notice this year we have several developments in the meter line — the outcome of the Canadian Standards Association. The manufacturers are producing meters which endeavour to comply with the wishes of the users.

The big work of the N. E. L. A. Meter Committee this year has been a complete revision of the Metermen's Handbook. We all know of this book. The new book is a complete revision, brought up-to-date, and will contain information which has never been published before. I would advise all those interested to obtain a copy.

In conclusion I would like a wide discussion of our report. We have several meter men of prominence here today.

(Applause)

R. J. BEAUMONT: Before opening the discussion on the Meter Committee's carefully prepared report, there is one little thing I would like to mention. I think the members of the Meter Committee deserve the Order of Merit because of all the Committees. I see they seem to be well represented here this afternoon. Out

of a Committee of about ten, I can see seven or eight in the room now.

There is one question I would like to ask, but will not put to some of the members of the Committee. I will just suggest what might be. It is relative to cost. I will now ask Mr. Higman if he will address the meeting. (Applause)

O. HIGMAN:—Mr. Chairman and members of the Association, it gives me a good deal of pleasure to meet you once again. I may say that it was nearly thirty years ago when I first joined the Association, and I see very few indeed of the members present who were members then. My friend Mr. Dion is one of them but I am sorry to say very few now remain.

I have a few regrets also to offer in connection with the meter subject. I regret that so little progress has been made in connection with the seal period matter; I regret that the Association when making their demand did not make it more moderate and I also regret that because of the insistence of the Association, so much time has been lost. Now, as to the ten year period, as you know the Act at present gives the central stations a six year period. That is, a meter is legally in use for a period of six years. At the expiration of six years unless reinspected it becomes illegal. Mr. Holder called attention in his report to the exceptionally small number of meters that were outside the limit of error permitted by the law at the expiration of the six years. I would point out, however, that the statistics from our Inspectors do not agree with those of the Association. The meters that are brought to us by the larger Companies for test before being fixed for use are 90 per cent accurate because they have been overhauled, adjusted and tested. The meters, however, that come from the smaller Companies and which come directly to our Inspectors tell a wholly different story. We find in the record of those meters that at least 25 per cent of them are outside the limit of error permitted by the law or approximately 6 per cent slow and 9 per cent fast.

In spite of the fact that the law gives you six years before retest is necessary, we find Companies bringing in, during the first three or four years of the test period, a large number of meters for reasons best known to themselves. During the fiscal year ending the 31st. of March last not less than 36,000 meters were brought in by the Companies before the test period expired. Now, why were they brought in? Obviously they were wrong, or they would have been left in use. You will doubtless say they were slow and that you were taking care of your own interests. Very good, I have no objections to offer in this respect. The law cannot, however, recognize one party above the other. We cannot admit that our attention is to be given solely to the fast

meters and leave the Companies to attend to the meers that are slow. That is not the spirit of the Weights and Measures system. We are dealing with the subject from the point of view of accurate devices for measuring the commodity which is sold through them. It means little to us whether they be slow or whether they be fast — the meter becomes illegal if the error is outside the limit permitted by the Act. It will thus be seen that we have no opinion in the matter.

I think I might be permitted to allude for a moment to the practice in vogue in many of the larger cities of the United States and with your permission I shall read the following statements:

NEW YORK

D. C. Meters, periodic tests:
- Up to 25 amp., 30 mos.
- 25 to 200 amp., 10 mos.
- 200 to 400 amp., 12 mos.
- Over 400 amp., 6 mos.
- Installation tests within 60 days.

A. C. meters periodic tests:
- Up to 25 amp., single-phase, 42 mos.
- Over 25 amp., single-phase, 24 mos.
- Up to 50 amp., poly-phase 24 mos.
- Over 150 amp., poly-phase, 12 mos.
- Single and poly-phase, not over 100 kw., 2,000 volts, 12 mos.
- Single and poly-phase, over 100kw., 2,000 volts, 6 mos.
- Test before or within 60 days of installation.

MICHIGAN

D. C. meters periodic tests:
- Up to 50 amp., 18 mos.
- over 50 amp., 12 mos.
- Installation inspection within 30 days.

A. C. meters, periodic tests:
- Up to 25 amp., single phase 36 mos.
- Over 25 amp., single-phase 24 mos.
- Poly-phase up to 150 amp., 24 mos.
- Poly-phase over 150 amp., 12 mos.
- Installation inspection within 30 days.

ILLINOIS

D. C. meters, periodic tests:
- Up to 50 amp., 18 mos.
- Over 50 amp., 12 mos.
- Installation tests within 60 days.

A. C. meters, periodic tests:
- Up to 25 amp., single-phase, meters meeting code requirements, 48 mos.
- All others, 30 mos.
- Over 24 amp., single-phase, 24 mos.
- Self-contained poly-phase, not over 50 kva., 12 mos.
- Self-contained poly-phase, over kva., 24 mos.
- Transformer meters not over 50 kva., 24 mos.
- Transformer meters over 50 kva., 18 mos.
- Installation test within 12 mos. and inspection within 60 days.

MONTANA

D. C. meters periodic tests:
- Up to 25 amp., 24 mos.
- Over 25 amp., 18 mos.
- Installation tests immediately before or within 60 days of installation.

A. C. meters, periodic tests:
- Up to 25 amp., single-phase 36 mos.
- Over 25 amp., single-phase, 24 mos.
- Self-contained poly-phase up to 50 kw., 18 mos.
- Over 50 kw., 12 mos.
- Poly-phase meters with current or current and potential transformers, 24 mos.
- Test before or within 60 days of installation.

This information was obtained in January of this year.

Now, it does seem to me that in cities like New York, Chicago and Detroit where the Companies make the test, a ten year period would be in vogue did not the State authorities demand something different. It is the intention of the Department to revise the Electricity Inspection Act at the next Session of Parliament if this may be found possible. There are some features of the Act that may be deleted and other requirements to be inserted. Under the British North America Act we are confined strictly to the weights and measures system, that is, providing the primary standards, testing standards and the testing of all measuring devices through which commodities may be sold.

I notice an item in the paper in regard to the use of wax for sealing. This is a subject that has occupied my attention from time to time for a good many years, as to whether or not we should substitute lead tags for the wax sealing. There is just one difficulty in the way and that is, that with the wax and seal we are enabled to make an impress of the date of the inspection so that in addition to our index card we have the date on the seal of the meter. This may seem a small matter but it is a real difficulty

insofar as the Department is concerned and I have not yet found any method that will help us out as a substitute.

I feel sure that I have endeavoured to administer the Act as favourably and in as friendly a manner towards the Companies as it has been possible for a public officer to do. I have tried to meet you on all occasions in friendly way and to do everything in reason to meet the views of the Companies. If I have failed in some instances, do not blame me personally but you may blame the law, or the Government, or the system but I do not think that I am guilty of withholding a friendly ear to the Companies.

(Applause)

R. J. BEAUMONT: On behalf of the Association I would like to express our thanks and appreciation to Mr. Higman for coming here today, and also to thank him very much for the encouraging unofficial news he has given us. There is one little point I would like to ask Mr. Higman. Perhaps he might not wish to reply, but we would take it as being unofficial — that is, at the present time it is the practice of all power companies to declare before notary the voltage in each village or town they operate in. In making these declarations each year, it often occurs to many of us as to whether these records will ever be checked up, — whether steps are imminent, or coming in the future, by which the figures we report will actually be tested on the ground.

O. HIGMAN:—The requirements in the annual report are generally for statistical purposes. We have a great many inquiries from the trade and others to furnish particulars as to the installations in the different localities throughout the country. Some sales agent may want to sell you something and seeks his information as to the system in a particular place from the Department. He may want to know the voltage and if D. C. or A. C. and whether 2, 3 or 4 wire or whatsoever the conditions may be, and this we are enabled to furnish him through the information contained in our annual report. We require the information you furnish for the Departmental Blue Book and for no other purpose.

R. J. BEAUMONT:—Thank you very much, Mr. Higman. It probably might be a good thing for both the power companies and the public to have the voltages checked, so that everyone would know the conditions are as declared.

O. HIGMAN: I may say in reply that the voltage to be maintained to a particular customer does not come within our jurisdiction. We may test the voltage for our own information or we may test it if required to do so by the Company to ascertain if his switchboard instruments are correct. But insofar as the consumer is concerned the voltage requirements should be dealt with by your Public Utility Commissions.

R. J. BEAUMONT:—Thank you. The meeting is now open for discussion. Perhaps it will be interesting to hear some word from the manufacturers.

E. HOLDER:—Might I be permitted to add to Mr. Higman's figures? In the United States meters are tested on an entirely different system from the one followed in Canada. Most of the State Commissions specify that meters shall be tested after installation and after a period which they decide — every three or four years. The Companies maintain their own meter inspectors, who go around and test meters *in situ* without disturbing their operation. They connect the testing apparatus in the premises and test the meter where it is with whatever load may be put upon it. The meter is left undisturbed and adjusted if found inaccurate. It is adjusted by the company inspectors, subject to regulation by the Public Utility Commissioners. This is entirely different from our system, and no comparison can be made with our system of bringing meters in for test. Canada is the only country where the mter is brought in from the customers premises at the end of the period for reseal. Meters are not saled in the United States by any outside authority. The are sealed by the Company. The Company is allowed to go to the customer's premises and check the meter, but the instruments, method of testing and the test results have to be submitted to the Commission, who supervise the test and make sure it is carried out in a proper manner.

O. HIGMAN:—Perhaps you will permit me one word more in reply to my friend Mr. Holder. The question at issue is not as to where the meters are tested or by whom they may be tested but is altogether connected with the test period. I imagine that the large Edison Companies in New York and Chicago must require a fairly large army of meter testers to comply with the three or three and a half year test period required by the States already mentioned. The fact however that the Companies are permitted to test meters *in situ* does not relieve them of the necessity of bringing in meters for examination and adjustment. Those of us who have visited the large testing Laboratories of the New York and Chicago Companies must have been impressed by the large number of men constantly at work testing and retesting meters that have been brought in. They are compelled to bring them in for the same reason that you gentlemen bring in your meters before the expired period in Canada. You cannot persuade me that a delicate piece of apparatus such as an electric meter will stay out indefinitely without readjustment.

R. J. BEAUMONT:—There is one little point I am rather interested in myself, and that is whether the manufacturers have anything to say with reference to the type of box that different box companies are turning out. At the present time the box has been

standardized by different manufacturers in Canada, and it might be interesting to know if meter companies approve of the box as it is, or have any desires or wishes, or changes they might think necessary, because the power companies are buying these boxes, and there wil be a good many of them on the different systems in a short while.

S. B. LINES: Mr. Chairman, in regard to the question of boxes, I think the manufacturers are more or less willing to give the companies what they are prepared to pay for. They do not want to give them anything for nothing. It seems to me possible the question of boxes and standardization of them would be referred to one or other of the committees to bring in recommendation to manufacturers as to what is required.

Referring to Mr. Higman's remark I think the members of the Association would be interested to know of the co-operation we have experienced during the last year as manufacturers between Mr. Higman's Department and the individual manufacturers. When Mr. Higman was discussing with his Inspectors the new recommendations, they made definite proposals, then Mr. Higman extended to each manufacturer an invitation to come to Ottawa and discuss the proposals with one view of not insisting upon anything which would really increase the cost of meters unless it was absolutely essential. I know as an individual, and I think I am speaking for every manufacturer, we were all delighted to get the invitation and see the co-operation Mr. Higman was willing to give to us.

R. J. BEAUMONT: Thank you very much, Mr. Lines. The time is pressing and we have still got a rather extensive programme to complete inside of a short while, but if there is any further discussion, I will be glad to hear it.

E. A. STANGER:—I would like to know if any of the operating companies have had experience with meters which have been installed in exposed places, such as verandahs or back porches, where they are subject to dampnss and extreme changes of temperature.

MR. HOLDER: I might give one instance that came in our Department last year, of meter which consumer complained was going wrong. It was outside the house, in the winter time, with temperatures varying all the way from zero down to 20 below, and meter was found fast. When brought in and tested in the temperature of the test room, it was found to be O. K.

A. E. DION: In connection with that what Mr. Holder said, being in charge of the meters for the Ottawa Electric Company, we have had instances of meters exposed to extreme cold outside, and in hot places of almost 100 degrees, and we found meters slow in every case. They slow up by excess of either heat or cold.

In connection with manufacture, Mr. Higman suggested a lead seal be substituted for wax. It is an important thing to keep the date of inspection on the meter. The only case where we have had trouble at all was where the wax dropped out, due to manufacturer's fault in constructing the sealing cup. If it had been made wider at the base where the wax could slip right in, nothing coud pull the way out.

A MEMBER:—Mr. Higman raised the point of the number of meters that are falling down before the time period has expired. We know a certain nnumber of meters break down in service, and they are compelled to come in and be repaired. I do not know whether Mr. Higman includes them.

O. HIGMAN:—The meters I refer to are those brought in during the first, second, third and fourth year for causes which we do not know. Doubtless it includes the meters that break down and are in need of repairs. The smaller Companies have to trust our Inspectors very largely to look after their meters. I have one Company in mind where they had neglected to bring in their meters at the expiration of the six year period and it was only when our Inspector threatened to enter suit against them that the meters were brought in. Some three or four hundred meters were involved in this case. They were finally brought in by the Company, tested by our Inspector and again put into service and subsequently we received a very nice letter from the Company thanking us for forcing them to bring the meters in as it had meant a good deal of money in their pockets.

E. J. TURLEY:—On the question of resealing meters and seal period, I believe that 90 per cent of trouble is due to rough handling on the part of our installers. I think that is a point we dealt with in Meter Committee's report; and the point we have spent a lot of time on in the last couple of years is to find methods whereby meters will be protected in transportation. The smaller companies are not subjected to so much risk, because the bigger companies handle so many more meters in shipment. Another point is they will bang the seals, and a lot of meters which are only out two or three years are broken. The wax seal has some advantages in that way. If the meter gets a hard enough bang to break the seal, it should be retested.

R. J. BEAUMONT:—Thank you very much, Mr. Turley.

A gentlemen got up in the back to enter into the discussion?

F. A. CHISHOLM:—I will bring it up under Time Contracts.

R. J. BEAUMONT:—Any further discussion?

A. P. DODDRIDGE:—We brought in some 115 meters during the past year which had been fifteen to sixteen years in service, and there was only one out of the 115 that was outside Government requirements.

O. Higman.—I was just wondering why he wasn't in jail. (Laughter)

E. Holder: May I also mention the spirit of co-operation shown by Mr. Higman's Department? In drawing up proposed new regulations he submitted these regulations to the Canadian Electrical Association, and we had an opportunity of discussing them with Mr. Higman. I want to add my tribute to that of Mr. Lines. At our meetings we always looked upon him as being willing to meet us in every way possible. I think Mr. Higman is to be congratulated on the co-operative spirit shown both towards the power companies and meter manufacturers. (Applause)

A. A. Dion:—I wish to second what has been said. It seemed quite unnecessary for Mr. Higman to assure this meeting that he was friendly to the companies. I can bear witness to this, and his desire to meet us at every turn. He has gone just as far in that direction as he could do as a public official, and it is a simple act of justice to pay this tribute to him. (Applause)

A. G. Grier: I merely wish to add that Mr. Higman has met us more than half way.

E. J. Turley: I would like to congratulate the Committee of the Canadian Electrical Association that arranged to have Mr. Higman a member these thirty years. (Applause).

R. J. Beaumont: Any further discussion?

As that seems to close the discussion, I move the adoption of this report, and will be glad if you will signify your wish. (Applause)

The next item is the report of the Overhead Systems Committee, Mr. Dion, Chairman.

(See Report in Advance Proceedings)

A. A. Dion: The report of the Overhead Lines Committee for 1923 is not very voluminous, and I am only touching on a few of the points. The first move of the Committee was to send a circular to all the member companies, asking them what subjects they wished the Committee to take up and consider during the year — what their problems were — and this report deals exclusively with these things suggested by member companies.

One of the subjects was with regard to B. C. cedar as compared with eastern cedar poles, particularly with reference to rotting of the sap wood of the farmer. This subject was not dealt with by the Committee, because it is now in the hands of the Engineering Standards Committee, who have already had one meeting on the subject. They intend to treat it thoroughly with the object of bringing out some working specifications at a later date. Any work we might do on this subject would be a duplication or overlapping of their efforts.


HEAT
STORM
RUST
FROST
It's the quality in
The Peirce
that protects —
DEPENDABLE -
sold on quality only —

One subject which occupied our attention, and one upon which the companies expressed considerable curiosity, was that of temperature indicators on transformers. We regret to say we did not get sufficient response from the few companies that have had experience with them to bring in any satisfactory conclusions, or anything that would be of use to the member companies. We are passing it on to the next year's committee to further study the subject. There has really been little experience in this country, and it would be unfair to bring in recommendations at this date.

One other question we were asked to consider was the construction to be used at street corners. As you know, on account of the automobile traffic, cities are rounding the corners of the streets wherever possible, to make it easier to return. Where a single pole is used at the corner to carry two lines at right angles, it seems that the simplest way of getting over the difficulty is to put in two poles and carry one line over the other. However, this was put in a questionnaire, because we had been asked to consider it, but there was so much diversity of opinion from those who responded, and so much indifference from the greater number, it did not seem to sufficient importance to bring in any recommendation.

The subject was suggested by a manufacturing company, the non-fusing of large transformers. Consensus of opinion of your committee, and of those who replied to the Committee's inquiries on the subject, was that it would be inadvisable to omit fuses even on transformers of very large sizes because where transformers were banked it was necessary to have selective action in order that one defective transformer might not cause the burn-out of the whole bank. It was pointed out however that in underground work, transformers installed below the ground, fuses had to be omitted because if used they would have to be placed in water-tight containers, leaving no vent for expulsion of gases. What seems to be needed, in the opinion of your Committee, is a better fuse-box and better fuses for transformers of large size or operating on high voltages.

Mr. Dion then read the balance of his report, from the foot of page 35, and page 36, of the Advance Reports.

He then continued on with:

We did not do very much. Most of the matters that presented themselves have been so fully dealt with by the N.E.L.A reports of this year and last year, it seemed foolish to go over the same ground. (Applause.)

R. J. Beaumont: Before opening this paper for discussion, I would like to say a few personal words with reference to Mr. Dion. I do not know whether you are all aware that Mr. Dion has been connected with the Association for a long while, and has fill-

ed the offices of President and Vice-President, and today he is an example to all our members. In addition to helping on the work of the various committees, Mr. Dion is ever ready to take a trip to New York and Chicago and represent us, and continually is ready to give us advice in the direction of the Association. Today we find him working as hard as a member that has only been with us for one year. (Applause.)

The meeting will now be carried on by Mr. Trimingham, of the Southern Canada Power Company.

J. H. TRIMINGHAM (in chair):—Gentlemen, this paper is open for discussion.

In connection with the discussion, there is one item that occurs to me, namely, in connection with requirements for crossings of power lines over communication circuits. Last year we had one instance where we were called upon to give clearance of ten feet, where the Bureau of Standards required six feet for the same voltage, over communication circuits. I am sure if the Association follows Mr. Dion's recommendation, that we take some action in connection with this, it will receive favourable consideration on the part of the Board of Railway Commissioners.

Would any one like to discuss this paper?

WILLS MACLACHLAN:—There is one point that I would like to bring out, but which is not touched on in the report, on overhead lines, but the question of the training of linemen will have to receive some consideration by this Association, and by the utilities generally, than it has been receiving in the past. Possibly in looking at some three hundred utilities in Ontario I get a glance on those that a man does not get dealing with one utility, but the trained lineman and foreman is getting to be a scarcer and scarcer article. I saw a bunch of linemen and line foreman together before a superintendent about three months ago, and I threw the question of grounding into the conference just to see what happened. There wasn't one who knew why they grounded. Now these simple things that are A B C to the man in the electrical work, or the engineer who has gone into it, are not understood to any great extent by the working force. The handbook for line construction is of value to the engineer, but to put it into the hands of the line foreman, or the straw boss, or the lineman that wants to go up in the business, is not of great value. In the NELA they are developing a course for linemen — a straight educational course for linemen. Quite recently I went over a series of questions put to line foremen, or linemen who want to become foremen, with the Commonwealth Edison Company. I doubt very much if many engineers could go through those questions and get anything like a mark after they have been through them. We have to develop some method, and I would like to see the Association make it a

part of the duty of the Overhead Systems Committee for the coming year to deal with the human element in overhead construction. (Applause.)

J. H. TRIMINGHAM:- Thank you, Mr. Maclachlan.

A. A. DION: In speaking of the work of the Overhead Committee, I omitted entirely to speak of a very important subject which is dealt with in the printed report, and one upon which it would be interesting and valuable for this Association to hear from members who are familiar with it, and I would be glad to be permitted to read a few paragraphs. I refer to the 3-phase, 4-wire, 4,000 volt distribution. I would like to read a small extract of what your Committee says about it.

(read from page 32 of the Advance Proceedings).

(Applause)

A MEMBER: Mr. Chairman, the question of fuses comes up so often, I think Mr. Dion ought to be asked to mention briefly the system developed at Ottawa for fuse wires. He put that in the report of the N.E.L.A. I think he ought to have mentioned it here.

R. J. EVEREST: In connection with the use of the common grounded neutral System, I would like to ask if any of the Canadian Companies have had experience with this System. As everyone knows the common grounded neutral system makes use of the same wire for the neutral of both primary and secondary, referring, of course, to a 4 wire, 3 phase, 4,000V system.

I have transferred one of our towns and the results have been very satisfactory. At first I felt rather reluctant to make the change, not because of any lack of confidence in the system but from a safety point of view.

In the past we have always instructed our linemen that primaries and secondaries must be kept as far apart as possible and then on introducing this new system we instruct them to tie both secondary and primary together. It looked, at first, as though it would cause confusion and it took me sometime to make up my mind it was possible to make the change, this is a point which requires careful attention and the Line Department should be instructed as to why it becomes possible.

J. H. TRIMINGHAM: I think there is a question before Mr. Dion in connection with fusing transformers. You were asked to give some information that you gave the N.E.L.A.

A. A. DION: This is a ittle scheme our line superintendent got up. We found our linemen used wrong fuses because they did not have the right ones. We got a little leather pocketbook with vertical sections, and in each section certain sizes of fuses were put in, the number of amperes capacity being market on the poc-

ketbook. Several sizes of fuses were put in, cut to the right length. On the other side of the folder there is space where card slips in, which gives the facts as regards the size of fuse to use on different capacities of transformers. Each lineman carries one in his pocket, and once a week has got to produce it to show he has a full stock of the different sizes. A member of the NELA happened to know about it, and asked that we should give him a photograph of it that he might put it in the NELA report. He thought it a very nice thing.

WILLS MACLACHLAN:—In connection with the four wire grounded proposition. The City of Toronto have been operating that way for about twelve or thirteen years. Their Superintendent put it in, and if you go back in the Proceedings of the CEA you will see report from Mr. Mills, either in 1911 or 1912, giving full details of the system he put in at the time. They are having no particular trouble with it. As a matter of fact they run a single primary away out to the transformers, and then put the transformer ground on to the ground of the secondary.

E. A. STANGER:—I might say that our Company cut over a town this spring from 3 phase 2,200 V distribution to four wire three phase common neutral, due to growth of a heavy load about three miles from the substation. As our standard secondary construction is on vertical racks with the top wire grounded at every transformer and house service, the only new wire required was a neutral for three phase feeder to a single phase line to a summer colony. The neutral was not carried farther than this single phase ine but was derived from the bank or power transformers at the end of the feeder, grounded and run a short distance back to pick up a few customers.

This scheme of using one wire for primary and secondary neutral and carrying it in the top position of the vertical secondary allows simple identification of the neutral, among other advantages.

Thorough grounding can not be too heavily stressed when operating a common neutral system. A case occurred on this cutover that brought this home forcibly. The single phase line referred to was cut over to one phase wire and the neutral. Some time afterward we received a telephone call to the effect that all sockets in customer's house were charged. Investigation showed that premises were not grounded, and that considerable potential existed between secondary and ground. After installation of ground wire this disappeared.

Besides the article mentioned in the Electric Journal, there have been several articles and considerable correspondence in "Electric Light & Power" by Mr. Hood, who is responsible for the first of this type of installation in Canada.

While this system has not been in operation very long at 4,000/2,300 volts, so far no trouble has developed outside of one case which originated as far as we can make out in a potential transformer in the substation.

The feeders cut over were not new ones by any means. It had grown gradually and some of it might have been expected to show weak spots under the higher operating voltage. This has not been the case, however, which would seem to indicate that there is an ample factor of safety.

A lesson learnt from the cutover was that a very careful survey of the work to the end of the last primary spur should be made a few days before the work is begun and the whole operation mapped out on paper and divided up into sections, depending on the force available, with written instructions covering each item to be done with a time schedule for each.

The particular cutover which included roughly six miles of primary was made from nine o'clock Sunday morning to 6 o'clock in the afternoon, and included reconnection of each single transformer and power bank and replacement of a few spans of primary. The work was done with nine men, including foreman — a group of three at the substation when the busses were rebuilt, and a new H. T. transformer installed, and two groups of two climbers and a foreman. (Applause.)

J. H. TRIMINGHAM: The next item on the programme is the report of the Underground System Committee, Mr. Kenyon, Chairman. Is Mr. Kenyon present? It there anyone who could take this paper for Mr. Kenyon? If not, we will have it tomorrow.

ACCOUNTING SECTION

Chairman, MR. W. PAXTON LITTLE

Treasurer, Canadian Niagara Power Co., Niagara Falls, Ont.
Treasurer, The Niagara Falls Power Co., Niagara Falls, N. Y.

CHAIRMAN: The meeting will now come to order. Mr. Davies has been kind enough to take a few minutes from presiding over the general meeting and as he is here with us now, I would like to call on him for a few remarks.

MR. DAVIES: I have very great pleasure in coming here and welcoming all who are attending this section. This is the first real meeting the Accounting Section have ever held. We have had some small meetings previously, but for some reason or other have never had a real meeting. It is very pleasant indeed for me to see such a good attendance today and I hope it is only an earnest beginning of very much larger attendances in the furure. Mr. Little, I will introduce him to you, is from the Canadian Niagara Power Company, of which he is Treasurer. I think he is also Treasurer of the American Niagara Power Company. He has been

Chairman of your Committee for the last year and we have great pleasure in leaving this Section with him as Chairman. I am sure you will all gain something in knowledge from this meeting and I will ask you to assist him with some discussion on all problems. It would be really most helpful and would be more valuable even than the printed reports. (Applause)

CHAIRMAN:—I am sure we all appreciate having Mr. Davies come in and open the meeting. Mr. Davies has been a great help to me and to those members of the Committee who have done work for the Accounting Section for the last year. The Accounting Section has functioned in the Canadian Electrical Association, but, I think due to the war, it slowed up considerably and ceased to function for perhaps two or three years. Col. Street, my predecessor as Chairman of the Accounting Section, made a valiant effort last year, but largely owing to pressure of other duties, could not give the matter the attention it required and did not have a great deal of success. It is particularly gratifying to have with us so many representatives from the N. E. L. A. who held a meeting here yesterday and are with us at this Convention. That is the right kind of spirit. I would like to see more of our people go down to New York and attend sessions there. I am quite sure you would be very welcome there, just as the N. E. L. A. people are welcome here in Montreal. It certainly is very pleasant to come to Montreal and we are glad to be here, although we don't like your hot weather. It is pretty warm, and we are late and behind in our schedule. The first Committee report was Accounting Education. Mr. Louis Kon was Chairman of this Committee but I notice he is not now in the room, so in order to keep the meeting going, I will call on Mr. Jansen to give us the report of the Committee on Accounts Payable Records.

The gentlemen can either read their reports, which are already printed, or they can abstract them, and afterwards we will have some discussion on the reports as they are printed.

MR. JANSEN:—Mr. Chairman and Gentlemen. My report is a very brief one. The work of the Accounts Payable Records Committee was mostly done by correspondence because of the difficulty of getting the members together — they residing in different cities. The members of the Committee prepared a description of the methods of handling Accounts Payable Records and likewise submitted forms in use by their own companies. These were forwarded on to Mr. Davies, Chairman of the National Committee, and whom it is a great pleasure to have with us today. His Committee investigated the methods of some 92 companies. I believe that their report as printed and presented at the recent Convention of the N. E. L. A. at New York, which I had the pleasure of attending, is available to all the members that are interested in that particular

work. This is about all I have to say, Mr. Chairman. The report of the N. E. L. A. covers the proceedings very fully from the time the invoice is received from the Purchasing Department until the account is paid. (applause)

Chairman: Is there any gentleman who would like to discuss the Report or make any suggestions in regard to the work of the Committee on Accounts Payable Records, or ask any questions?

Mr. Janssen: I might say that the Report of the N. E. L. A. does not deal with any machine methods which are in use by some of the larger Companies, the Report dealing rather with the methods in use by average Companies.

Chairman: Mr. Davies, is there anything you would like to say?

Mr. Davies: I do not know, of course, how far the report, presentation of which was made to the N. E. L. A. may be applicable to conditions in Canada, but I may say that in our investigation in the United States we found there were no great differences I may say that one of the most interesting methods I found was in use by a Company in Tennessee where it was found inconvenient to use an Accounts Payable Ledger. This condition we found so general in our investigations that for that reason we avoided it entirely, but it is a question whether that method would be favored by Canadian Companies. One of the outstanding features was that no invoices left the Accounting Department. The prices were shown on a copy of the Purchase Order which was sent to the source of the purchase. Arrival of the goods was noted on this copy and it was returned to the Accounting Department. Upon its receipt, the invoice was extracted from the files and passed for payment. One advantage of this system was that it prevented loss of invoices and they were always a source of record. I am given to understand that the system worked satisfactorily. There would be objections from people who would say they never saw a copy of the invoice, but I understand that was provided for on the Purchase Order.

One more point. The Companies that are keeping them seem perfectly of opinion that they should be kept, but we have found that the bulk of the Companies now do not keep Accounts Payable Records and they would seem to be an obsolete and unnecessary function. The forms are not standardized at all. They all accomplish the same purpose and mostly the differences are a matter of personal preference. I do not think the report is absolutely perfect, yet, in the opinion of the Committee, it was the best we could do from the information available, and while we submitted the Report as covering only some 92 Companies when it was presented to the National Association, yet the number of Companies

actually investigated was approximately between two and three hundred. (Applause)

Mr. Johnstone:—Mr. Chairman, I do not want to bore you, nor appear to be anxious or create a discussion, but Mr. Davies has said that the general opinion was that the Accounts Payable Ledger had become obsolete, and I may say that I belong to the old school and consider it very necessary. Of course, it may be because of conditions pertaining to our particular Company. It may help me, of course, to see the light if I could get some more information to cover such cases as, for instance, in the event of a Company not using a voucher cheque system, or perhaps not using a voucher system at all. If all accounts are not paid in rotation or not paid as they come up or as they come up or as they are presented, it means that some will be paid within the stipulated time (or earlier, if there is a discount clause attached) and it may mean that accounts held over for several months, for more than one reason, are liable to become lost sight of. Another point occurs to me, and I am raising these points just to find out, if I can, how a system that has no Accounts Payable Ledger takes care of them. The point is, in the event of an invoice being lost in the first instance in the mail, or in the office of the Company receiving it, the Company would have no record of its existence at all. When the lost invoice subsequently is presented, those who do not use the Accounts Payable Ledger, will have to go through all their vouchers from that particular firm of suppliers and ascertain if that invoice has been previously executed. Now, there is in my mind another point, it may be a very small one, but I can remember when in one of our subsidiary companies, where we had a voucher system, it was found on one or two occasions that payments had been duplicated. Has the Ledger been discontinued because of the work involved? Of course it may be because of my ignorance of the way the matter is involved, but to my mind the work of keeping the Accounts Payable Ledger should not be any greater than it is in connection with the voucher cheque system. For instance, invoices have to be detailed on a voucher for the month or other period stated, and total voucher posted in the record. On the other hand, the invoice has to be posted individually in the Accounts Payable Ledger, and I am just wondering if my idea of things is leading me astray and if I am putting in an extra operation which does not occur under the voucher system. Now, if these questions of mine can be answered today, I certainly should appreciate hearing about it, because I am sincerely looking for information and have no objection to the voucher system except that I do not see, myself, where it is an improvement over the Accounts Payable Ledger system. The difficulty appears to me to be where invoices are not paid in rotation. In our case we may have invoices

outstanding for a considerable period. I have one case in mind now where an invoice has been outstanding in connection with a construction job for three and a half years. That is only one outstanding item, but there are others which have been outstanding for quite a number of months. It seems to me that some record of these outstandings must be kept. If I could get some little word on this I would be greatly obliged.

Mr. Davis: I may say that we do not want to give the impression that we condemn the Accounts Payable Ledger. We have found cases where the use of this Ledger was justifiable. There were cases where the Companies felt they had to keep the books for the concerns they were doing business with, because they did not have much confidence in those concerns. But the reason we paid no attention to the Accounts Payable Ledger was because we found so few Companies using it, and therefore naturally the conclusion was it was found that they could be dispensed with. There are various ways of overcoming the conditions you mention. I think possibly a careful reading of the Report will reveal them. One method I might outline is that of the use of the Voucher Cheque System. One of the very large Companies investigated made an extra copy of the voucher cheque on plain white paper. Full details were given, of course, on the cheque. That extra copy was filed, each firm's white copies coming together in chronological order. But they did not follow the practice of posting their payments. It was just simply a record or checking system, for the purpose of preventing duplication of payment. Of course, it was necessary for their Purchase Order to be such that their Purchasing Department would catch any duplication of invoices. Of course, the bonus should rest with the Accounting Department, but the Purchasing Department should provide a check. If, for example, you receive a statement from a vendor on which is indicated an item three months old. You have no record of the invoice. You may have paid it and the vendor has not credited the account. The first step would be to refer to your white copies of the voucher cheques to see that that item has not been previously vouchered. If it has not been, you are pretty well sure that you have not had this invoice previously. You then go to the Purchasing Department and their records will also show whether that particular invoice has been previously rendered. These two checks will be sufficient to guard against duplication of payment.

Accounts Payable Ledgers are sometimes found quite valuable by Executives of some Companies who require a good deal of information as to the amount of purchases made from individuals or firms over a period of time. If you have an Accounts Payable Ledger, this information can very readily be supplied.

Another system is the card system. A card is made out for

each Vendor. As the invoices come in they are listed on this card under the Vendor's name, showing date, goods purchased, amount, etc. That is another reference for your Accounting Department.

I trust I have answered your questions?

MR. JOHNSTONE:—You really answered my question when you said that the system depended on the Voucher Cheque System.

CHAIRMAN:—Any further questions? Gentlemen, we will consider the discussion on the Accounts Payable Records closed.

Gentlemen, as you all know perhaps, we have with us as guests a number of gentlemen from the N. E. L. A. Accounting Section, and I am going to ask Mr. Jones, Chairman of the Accounting Section of the N. E. L. A. to say a few words to us.

W. A. JONES:—Mr. Chairman and Gentlemen: On behalf of the officers and members of the Executive Committee of the Accounting National Section, I want to express our thanks for your invitation to meet with you in convention here and for the cordial manner in which we have been received. We had a number of reasons for coming to Montreal. The first was to render some enthusiasm if possible to the accounting sessions, another was to get something of an inspiration ourselves for the work ahead, and the third very pertinent reason it is perhaps not necessary to mention

In the general session this morning I attempted to make an appeal to the chief executives of your companies for a more whole-souled support of the work of the Accounting Section. I hope that throughout the year you accountants from the various member companies will be encouraged to participate in the work of the Accounting Section of the Canadian Electrical Association. I am sure you may do so with profit to yourselves and to your several companies. It must be remembered that only to the extent to which you enter into the work of the Section can you hope to benefit. The slogan of International Rotary is "He who serves best profits most" and that is a real truism. It applies to almost anything you undertake and it applies especially in the public utility business.

You often hear at association meetings of this kind a distinction made between the accounts of an organization and the executives of an organization. In my opinion there is no better training school for executives in any business than the accounting organization of that business. If the accountant will avail himself of the opportunities which lay before him, he can quickly train himself for the analytical study of the most difficult business problems. There is a vast difference between an accountant, a bookkeeper and a clerk and sometimes these terms are improperly applied.

The object and real purpose of the Accounting Section of the Association is to promulgate and disseminate sound accounting

and financial principles. Important work of this nature cannot be delegated to clerks and bookkeepers and if we are to be worthy of recognition for the honors of our respective business enterprises, we must deliver a class of work more valuable to the management than that of the day laborer. I am satisfied that if you members of the Accounting Section of the Canadian Electrical Association will show yourselves to be leaders of thought and place yourselves in a position to render service of a high quality, that you will not need to clamor for recognition from the executives of your respective companies.

We, members of the Accounting National Section, wish to place at your disposal the experience of some years of association work. Those of us who attend the Convention have been more than compensated for our visit and have carried something of the enthusiasm which is evidenced here away with us. We hope that in the future, we will get to know each other much better and that we may mutually benefit from closer association.

So if I can leave this one thought with you, I shall be well satisfied. (applause)

CHAIRMAN:—I am sure we are all very grateful to Chairman Jones for his inspiration and very grateful to him for coming up here from New York to attend our meeting.

I will now call on Mr. Johnstone to give us the report of the Budget Committee.

MR. JOHNSTONE:—Mr. Chairman, I am going to ask permission to read this report in case there is anything new in it, but the whole report is really propaganda or advertisement of the work of the Budget Committee of the N. E. L. A. We all know how these proceedings come to us in pamphlet form, but previously they came in bound form, with the result that if the individual was interested in one line of work, he would read the report of the Committee looking after that work, with the result that by many men in Canada the work of the Budget Committee was very much overlooked. As I said before, this report is simply a digest or outline of the work of the N. E. L. A. Budget Committee, for the purpose of getting our Canadian members interested in Budget work and letting them know where the Report can be found. I may say that to our visitors from the N. E. L. A. these words will sound familiar, on account, of course, of their coming from the N. E. L. A. Proceedings.

(See Report in the Advance Proceedings)

(Applause)

CHAIRMAN:—I am sure the Section is very much indebted to the Committee for its Report on this very important subject, and it is a subject which is arousing more and more interest, and more Companies are becoming interested in it and installing it as part of

their work. I think the Committee has advertised the Budget very well, myself, and I hope the Committee will continue its work through the year and that all the member Companies will give to the Committee any help it needs in conducting this Budget work. I think I might say that no Company is safe to operate without a Budget System. Mr. Johnson, I believe the Bell Telephone Company uses the Budget system and I would like to have you tell us something about this subject.

MR. JOHNSON:—I have very little to say, except that I was impressed by the similarity of the proposals of the N. E. L. A. Committee to what has been in effect in the Bell Telephone Company, which I represent, and also with Telephone Companies in the United States, for quite a number of years. We have been operating under a "Term Budget" for some years and would not consider abandoning it. It gives us a knowledge which we must have of the development of the Company. We have within recent times introduced a "Continuous Budget," running concurrently with the Term Budget, which is revised from month to month according to the later knowledge which has been gained. Under this plan we forecast our Term Budget for one year ahead, and we are running our Continuous Budget from month to month, comparing and adjusting it with the actual results as they are produced. In addition, we are endeavoring to get a Term Budget for five years ahead; rather an ambitious undertaking, but one that we hope to make effective and place a good deal of confidence in. It is in course of development at the present time, and we quite admit that there is room for improvement. As I said, I was impressed with the similarity of the problems which the N. E. L. A. have before them on the question of budget matters and which the Telephone Companies also have before them, but we do not consider that we could get along without either the Term Budget or the Continuous Budget. They enable us to get a proper prospective of the business, and enable us also to make such changes in our program as the financial status and operating results show to be necessary. I heartily endorse Mr. Johnstone's remarks.

CHAIRMAN:—Any discussion? Any questions?

Gentlemen, we have among our among our guests Mr. William Schmidt, Jr., Past Chairman of the Accounting Section of the N. E. L. A. and I am going to ask him to say a few words to us. Perhaps he will tell us something about his ideas on the subject. (Applause)

MR. SCHMIDT:—Mr. Chairman and gentlemen: As Chairman of the Accounting Section of the National Electric Light Association, I want to thank you for your kind co-operation. Your Chairman has been most helpful and has given me the utmost support, and I trust that the incoming Chairman, Mr. Jones, will

receive the same support as I received last year. Speaking of the year's work, I think it is to the interest of all accountants to take an active part in the work of the national, as well as the local Accounting Section, and there is just one thought I would like to drive home and in order to do so I will read a paragraph or two from the report I made as Chairman of the Accounting Section of the National Electric Light Association:

"Not only the Accounting Section, but the entire Association, is a credit to the men who have given so much time to the work summarized in the reports read at this Convention.

"Committee members have given freely of their time and effort and have been well supported by their Companies, because they realized they were doing a work of great value to the industry.

"Although they looked for no reward the members are bound to reap great benefit from the interchange of ideas and if for no other reason the Companies should be anxious to have their members attend these meetings. It is of actual undoubted value for them to do so.

"The Public Utilities business is unlike any other in that it is very rarely that there are competing companies in the same district, so that each can give fully of his experience and advice. The knowledge gained will not be used in competition; therefore, let us have co-operation.

"When meetings are called in Western States, members from the East and South should attend these meetings and members from the Western States should likewise attend meetings in other parts of the country. This is a fundamental basis of contact obtained with men having similar difficulties and doing similar work, with a view to overcoming them."

During the coming year the Accounting Section meetings will be held in different sections of the United States and I trust that when notices are received from Headquarters, members of the Canadian Section will attend these meetings. I am sure they will carry back with them ideas that will more than compensate their companies for the expenses of the trip.

In going to a convention I always make it a practice to bring back with me some idea that reimburses the company for the expenses of my trip; and I feel sure that if every man in this room, in going to a committee meeting or to a convention, will bear this in mind, he should have no difficulty in being permitted to attend these meetings or conventions. I know some men who go to a convention just to have a good time. The thing to do is to be faithful in attending meetings; pick up ideas; take them back home and sell them to the management of your company. I have done it, others have done it, and you can do it to. (Applause)

CHAIRMAN:—I am sure we are all very grateful to Mr. Schmidt for his remarks and particularly on the subject of the importance of members attending these meetings. I know I have dwelt on that subject at a good deal of length in the past. It is reported to have been said by some of the people that we refer to as Executives, (I suppose that means General Managers) that these meetings are a waste of time. That is a mistaken idea. It may have been true in the past but it is not true today. Men coming to these meetings give up their time to work, and work hard, and even to putting in a little over-time, and I hope that some of the things that were said in regard to this subject this morning at the general session and at this meeting this afternoon, will come to the attention of the managers of the Canadian Companies. If they don't, we cannot make a success of the Accounting Section, because we cannot make a success of it unless we have full attendance at meetings in Canada and also have attendance in the United States at the N. E. L. A. meetings.

We have departed from the programme, I find, but we will start over again and ask Mr. Fee to report on the work of the Classification of Accounts Committee..

MR. FEE:—This was a very easy task for the Committee as it proved. We found that the larger Canadian Companies followed fairly closely the Classifications as recommended by the N. E. L. A. There was nothing actually that we could do in the way of Committee work, and as the N. E. L. A. Classification has just recently been revised, we felt that we could only recommend to our Canadian Companies to adopt it to such an extent as they thought advisable and for their own immediate best interest. That is about all, Mr. Chairman, that I have to report for this Committee.

However, if I might supplement your remarks just now in stimulating the interest of our Canadian Companies in the N. E. L. A. work, it seems to me that we might almost have a Committee which would have for its sole duty the interesting of executives of the different Canadian Companies to send representatives to the N. E. L. A. Annual Convention and as well to the Accounting Section Committee meetings. There are about four of them to be held and it seems to me that, as has been pointed out, it would not mean a very great hardship for the Companies to send down one or more representatives to these meetings, but at the present moment I think we are a little indifferent, on our part, and I feel that our own Companies would really benefit if they were represented at these Conventions. I think, Mr. Chairman, I cannot say anything further on the subject, which already has been so well covered by others. (applause)

CHAIRMAN:—Your Accounting Section, at its last formal meeting preceding this Convention, instructed me to invite Mr. H.

M. Edwards, of the New York Edison Company to come up here and address us. The executives of the Association took Mr. Edwards into the General meeting and proposed to deprive some of you gentlemen who were not there this morning of the pleasure of hearing Mr. Edwards. Now, we invited Mr. Edwards here, and while I do not like to overwork him, I certainly think we would all appreciate it if he would address a few words to this, our formal meeting of the Accounting Section. We would like to hear from you, Mr. Edwards.

Mr. Edwards:—I had rather hoped that I would be allowed to sit back and keep quiet. I exhausted my subject pretty well this morning and do not know that I can add very much. I left New York with the understanding that the Accounting Section of the Canadian Electrical Association, if not moribund, was not exactly the livest end of the organization. But I will have to change my ideas on the subject. I think even if the Accounting Section heretofore has been more or less inactive, it has certainly got a real good start this year.

There is just one feature in Accounting work in which I have been very much interested. I have been impressed for a number of years with the necessary reliance of the Accounting Department upon the work of other Departments of the Company. The Accounting Department isn't a Power House, it's a Sub-Station. It can put out nothing it does not first turn in. I had occasion this past winter to talk to the employees of my Company on that feature of Accounting conditions the idea being to show them that every man in the Company, no matter what position he occupies, has his part in the making up of the accounts of the Company, and it is on his reports and data, no matter how simple, that the integrity of the Accounting department work is based, and I think, if you follow back your work to the point where it begins, you will appreciate that in handling Accounting matters you are very largely dependent upon people outside the Accounting Department for the correctness and accuracy of your work. At the meeting referred to, I was amazed by the interest shown by some of the power house men, sub-station men, and men in the field generally. I was amazed at the interest they showed in the matter and the grasp they finally had of the subject we were discussing that night.

I do not know that I can say anything more, but if you will trace your work back to where it starts and interest the people who are making the preliminary records you will undoubtedly improve the character of your records. (Applause)

Chairman:—I think Mr. Edwards has given us a very useful thought, and those of us who have not been doing so might well put it into execution.

I am now going to call on Mr. Haskell for the report of the Purchasing and Stores Accounting Committee.

MR. HASKELL:—I have to apologize for the shortness of our Report, but I was only substituted as Chairman, not intending to carry on in this work, the other Chairman having resigned, they asked me to form a Committee. I did the best I could in short time to form a Committee and we were able to hold but one meeting. At that meeting, we considered the form of Stores Accounting of the two Companies represented and this was presented to the Section, which thought well enough of it to accept it as our report to you.

(See Report in the Advance Proceedings)

I may say, in passing, that our perpetual inventory system has cut down our losses from thousands of dollars a year to I would say a few hundred dollars a year since this inventory system has been in operation. (Applause)

CHAIRMAN:—Thank you Mr. Haskell and the members of the the Committee. Is there any discussion on this Report, gentlemen? If not, we will proceed.

MR. STEWART:—Does this report follow closely that laid down by the N. E. L. A. in procedure and method?

CHAIRMAN:—You will have to ask some member of the N. E. L. A. who is more familiar with the subject.

MR. STEWART:—The reason I asked, I think in 1920, I attended a meeting of that particular Section and they were having a warm discussion, in fact a heated one, and it was over which was the right method, if I remember. I was just wondering, because I would like for the sake of our own interests at home to know a little more about it.

MR. HASKELL:—Mr. Chairman, our Committee did not have time to go into the history of Purchasing & Stores Committee Work of the N.E.L.A. but from the information which we have from the Accounts, I believe of the Central Maine Power Company, we were led to believe that nothing in the Storeroom Accounting of the N.E.L.A. would take care of a Company which has stores scattered as the Central Maine has and also our own Company has, and so we went ahead and submitted this report as one example of Storeroom Accounting.

CHAIRMAN:—I think a comparison of the two methods might be left to the Committee which will undoubtedly be continued for another year.

Gentlemen, we have with us this afternoon a very patient listener, Mr. John Gilchrist, Vice President of the Commonwealth Edison Company of Chicago. I would like to have a few words from him before he leaves. (Applause.)

MR. GILCHRIST: Mr. Edwards and I came along together, and he asked me where I was going. I told him that I was going into the Accounting Section to see whether I could not at least get a few ideas on this subject of accounting. I have a feeling that that is the way all executives feel, the more responsibility they get, and the more they want to know what's what. I personally, with all due credit to Mr. Schmidt and the Accounting Section of the N.E.L.A., have recently gone into the question of merchandising accounting, in which I have become very much interested in the last few years, more or less, at first, as a hobby, and also because it happens to be a branch of the business I am responsible for. We did not know then what we were doing, and we do not know very much yet, but it is an end of the company's business which is growing very rapidly and merits a great deal of attention. I know the ablest executives in our industry the world over have demonstrated their belief in the very great improvements of the accounting end of our business by associating with them the very ablest accountants and giving them positions of executive importance. I know that with our company in Chicago, one of our vice presidents, and the one who perhaps has the ear of the president more than any other, is the vice president in charge of the accounting of the company.

I think this is becoming very much the situation, certainly in the big companies, and I presume throughout all the companies. I always like to attend the Accounting Section meetings, because, while I am not an accountant and do not know much about it, I have, ever since the Accounting Section of the N.E.L.A. was organized, found that there was more sanity, more live matter, and more discussion in the Accounting Section than in any of the other section meetings; that they got down to the practical side of affairs, and that they were dealing with tangible things anybody, no mater how little he knows about Accounting, could understand and appreciate the importance of, and it is that feeling, perhaps, that led me to pick out this section instead of the other.

It is a great pleasure to come here and meet all of you gentlemen, and I have found in the Canadian Section, as I have found in a good many of our own Accounting Section sessions, a getting together which I think possibly develops more real information and benefit than in the larger sections of the National Association. Thank you, Mr. Chairman. (Applause.)

CHAIRMAN:—I am sure we are all much indebted to Mr. Gilchrist for his remarks, and that he should select our meeting instead of the other section is a compliment. We will now hear the report of the Payroll Standardization Committee from Mr. Johnson.

MR. JOHNSON:—The Report that we have is brief but I think can be read for the benefit of those who did not receive it, or those who have not actually read the Report.

(See Report in the Advance Proceedings)

We were rather disappointed at the small amount of individual work that we were able to accomplish, probably it was due to a late start which we got, and also in some measure to the lack of information on pay roll methods from the Canadian Companies. However, I suppose that is a difficulty which probably the N.E.L.A. Committee experienced; we are not, however, entirely discouraged in our future efforts.

I would recommend that this Committee, in formulating its plans for the future, lay them out with the idea of co-operating closely with the N.E.L.A. Pay Roll Standardization Committee, gathering what data can be obtained from the Canadian Companies and submitting it to the N.E.L.A. Committee for inclusion, if possible, with the studies that Committee may make. Undoubtedly, if we pursue our own particular course, working independently and possible starting out where the N.E.L.A. Committee started out some time ago, covering just the same ground that Committee has already covered, we shall find that we have wasted a lot of time, and I think it better that our future plans be laid for closer co-operation with the N.E.L.A. Committee and the adoption of whatever recommendations they publish, insofar as this can be done. I do not think anybody here will dispute the importance of standardization of pay rolls, both in regard to the protection of the Company's funds and also to the efficient lines.

Speaking for the particular industry which I represent, when it is realized that probably 80 per cent of the operating expenses of the Company is represented in pay rolls, the importance of this work can be readily understood; the percentage may possibly be smaller in other industries. However, this is undoubtedly very important work, and I think the Canadian Electrical Association Accounting Section will derive more benefit and quicker results by closer co-operation with the N.E.L.A.

I have nothing further to add on this subject, but if there are any questions to be asked, I will do my best to answer them.

(Applause.)

CHAIRMAN:—Thank you Mr. Johnson. Gentlemen, as Mr. Johnson has said, this is a very important subject, and one well worth the attention of members of the Accounting Section and now we have gotten a good start here I hope we will have a very strong Committee next year and that the matter will receive a good deal of attention, and I am sure I can promise the co-operation of the N.E.L.A. with this Committee. Is there any discussion, gentlemen?

I am going to call on Mr. Fred R. Jenkins of the Commonwealth Edison Company of Chicago, Chairman of the Accounting Education Committee of the N.E.L.A. We have not had a Committee on Accounting Education because it was so late when we got started. Mr. Kon, the Secretary of the Canadian Electrical Association, thought he might be able to take up the work here but his duties as Secretary have been so pressing and his time so thoroughly taken up that he was not able to give the subject the attention it deserved and was unable to make a report on it. Mr. Jenkins.

MR. JENKINS: Mr. Chairman and Gentlemen: Perhaps the members here would be more interested in hearing what the Accounting Education Committee has laid out for itself during the coming year. Yesterday, we had a meeting here to revise the Advanced Accounting Course. The Advanced Accounting Course has 36 lessons. Yesterday afternoon we submitted these 36 lessons for revision to perhaps 25 men selected particularly for their special knowledge of the subject of each lesson. I want to emphasize that, because in the Advanced Course of this Section we have the final thought and final results of years and years of work and practice in the associated Companies, and for that reason you have before you in the Advanced Course the latest practices of the most advanced Companies.

I want to recommend that this year this Association has an Educational Committee and that they have an active Committee, because it is hardly to be expected that employees would go into the Accounting Courses unless they know something about them. It is true my Committee issues advertisements and information describing the courses, upon request, but it certainly needs the strong support of this Section, and from every indication since I have been here I know we are going to get it. We have had a considerable number of subscribers from the Canadian section. We have had some who have taken the Course and are enthusiastic over the results.

The Elementary Course of 16 lessons was fully revised last year and proved very satisfactory as a preliminary course. In fact, one of the large holding companies in the States made it a requirement that all their junior engineers take the elementary accounting course. There is a peculiar feeling in the different companies that their men are interested only in the reports issued for their section. A little incident may be of interest to you. President Frank W. Smith has offered for a prize $100 in gold to be given to the man in the Association who got the most tangible benefits in any course. Peculiar to say, this money was presented at the New York Convention, in the Commercial Section, to a District Manager of Electric Lighting Company of Boston, who took

the Accounting course, which shows that the live ones in the Association have a feeling that they must not only know their own work but they must know outside of their own particular line.

The Association publishes these Courses at a very nominal cost. They do not make any money on them and are several thousands of dollars in the hole now, in red figures. That does not worry us, however, because we know we will eventually get into black figures, provided we get the whole hearted support and assistance of executives and members who appreciate the value of these Courses.

I want to mention in passing the fact that the Advanced Course is selling for $40.00 and is preferable to any Correspondence Course of like size selling for three, four and five times as much. There is no question but that any man taking any of these Courses gets them for at least 20 c. on the dollar, and that is the reason for the Association doing it. That fact alone should interest a large number of people.

The way to introduce the Courses, of course, is through the executives. If more executives took an interest in this work, I am sure we would soon have a very large representation from this Country. I thank you. (Applause.)

CHAIRMAN:—I am sure that it has been a great pleasure to hear from Mr. Jenkins on this matter of Accounting Education and I am sure that through his remarks your interest will be stimulated in prevailing on the people in your Companies to take up these Courses. I am sure they are well worth while and it will help to build up our Accounting Section with men who have graduated in these Courses. We want to make this a good Section and anything you can do towards this end will be a great benefit to us all.

Our genial and hard-working Secretary, who has absented himself this afternoon, has just come into the room and his assistance has been of great benefit to us. We have made a lot of progress with his help in the past year since we started the Accounting Section, and I would like to call on him now to say a few words to the meeting.

MR. KON:—I do not believe that I have given any more assistance than anyone else, determined to accomplish something for the Association, would have. As there are many serious questions to be discussed, I am loath to take up any of your time, I wish, however, to state that it is most gratifying to see such a large attendance at the Accounting Section's meeting today despite the fact that it is held at the same time as a business session of another important Section of the Association.

If Mr. Little would, and I do not doubt that he will, continue the work he started a few months ago as a Chairman of the C.E.A.

Accounting Section with the same tempo, energy and spirit, and a bit stronger support were to be given to him by a larger number of Companies and individuals than heretofore, I am quite sure that within two years the Accounting Section of the C.E.A. would be on par as to strength and accomplishments with the Technical Section.

Personally, if I can at any time or by whatever means help Mr. Little and this Section, please just tell me — I shall be only too glad to take my coat off, if necessary even my waistcoat, and pitch right in to help.

Chairman: In the beginning of the year we appointed a Committee on Fixed Capital Records, or endeavoured to appoint a Committee. Mr. Bailey of the Shawinigan Water & Power Company was named as Chairman, but shortly afterwards, he was obliged to take up some construction work that took him away from Montreal and he was not able to get his Committee together and was unable to make a report. Our time was too short to get another Committee together under another Chairman, but I see that Mr. Breitinger of the Philadelphia Electrical Company is here, and I would like to call on him just to touch on the importance of the Fixed Capital Records to a public utility.

Mr. Breitinger: Mr. Chairman and gentlemen. The hour is growing late and I do not like to take up too much time. At the same time, I would like to leave one message with you. I do not want to repeat my performance at New York, where I promised I would only take about a quarter of an hour and took over three hours — or so they tell me. We have been scratching the surface on this subject during the past year, and the Report as submitted to the Association at the Convention in New York gave the best one of many ways possible, for the promulgation of Fixed Capital Records.

I think the situation may be somewhat different in Canada from the States on account of the absence of Regulation, but I feel that this is something that may come later and, as we all know, it is very nice to be prepared in case of emergency. The Report has been presented at the Convention in New York and I hav several copies in Philadelphia which I would be glad to forward to any one interested, or if any one wishes to call on me at Philadelphia, I shall be very glad to have them come and I am anxious, Mr. Chairman and gentlemen to be of all assistance that it is possible for me to be. (Applause.)

Chairman: I look on this as a very important subject and one well worth the attention of members of this Association, and I hope that next year we will have a Committee. We probably won't have the assistance of Mr. Bailey, but we will make a selection and will have the Committee get in touch with Mr. Breitinger

and I am sure that if the members of the Executive Committee and the Accounting Section will read with care the Report of that Committee which is now published, they will realize the importance of the subject and why we should have a Committee here. It does not matter whether you have regulation or not. It is a splendid thing for a Company to have a complete set of Fixed Capital Records.

Another very important subject on which we did not have a Committee and which we did not consider at the beginning of the year, was Preservation of Records. The N.E.L.A. had a very strong Committee on that work and we have with us this afternoon Mr. Heydecke, the Chairman of that Committee and I would like to ask him to tell us of the importance of that work, if he will.

MR. HEYDECKE:—Mr. Chairman and gentlemen. I will only take a few minutes to outline the work the Committee did last year. The subject of Preservation of Records was one which has not been generally considered by the Association or its member Companies up to a very recent time. The Committee in the beginning first brought it out with the idea of promulgating a standand rule for the orderly destruction of records and made an investigation of what rules and regulations a Company under the State Regulatory bodies ought to issue. After the Committee got in its first session, it was forcibly brought to its attention that the Preservation of Records was an even more important subject, and the event which brought this to light was the tremendous loss at the Chicago, Burlington & Quincy Railroad Company's office building at Chicago. This building was a very large office building and was supposed to be absolutely fire-proof, Class A. The fire broke out in a neighboring building and the particular emphasis that I want to lay on the story is that the C.B. & Q. building was partially destroyed and the records of the Chicago, Burlington & Quincy Railroad were almost completely destroyed. Now, if you gentlemen will stop to consider what would be the effect of the loss of the records in your office were the building to burn down tonight, not only the inconvenience caused by such loss but the reproduction value of such records, what would you do? If you lost your Customers Ledger, it would take a number of months to build it up again at tremendous cost, and so on through all departments.

The subject was first treated on the technical side, pointing out the danger of overlooking the proper preservation of records. We then took up the subject of the orderly destruction of records. We found that the Companies for years and years were accumulating records and they filled files and files and filing cases and cabinets and when the growth of the Company warranted expansion, they moved in to a larger building or built an addition, or hired additional rooms. For good reasons, the location of the

Company's offices are in the business section of the city, where rentals are high. One would not rent such a building for the storage of records and if the subject of the orderly destruction of records is taken up in a concrete way, probably the question of additional space will have been answered. The first duty of the Committee was to ascertain the ideas of the regulatory bodies on the subject, that is to say, how long did the regulatory bodies require to keep such records, and a set of rules and a code in connection therewith was presented by the Committee. Now, in connection with that, there is absolutely no compulsion about it. There is nothing to compel a Company to keep records after the expiration of the period that may be mentioned in the Report, but if a Company desires to keep their records for a greater length of time, they can do so. But there is a rule laid down and if the period is specified at say five years, and the Company wants to keep them for ten years, the Company is free to do so. Thank you. (Appause.)

Chairman:- I think after Mr. Heydecke's remarks, we will consider forming a Committee to study this matter. I am quite sure this is a subject that has not been covered to any great extent by any of the member Companies.

There is another very important subject that the Section did not feel able to deal with this year, and that is the Customers Record and Billing. I am wondering if you will say something to us on the subject, Mr. Beaudin.

Mr. Beaudin:- Mr. President and Gentlemen: I came here as an unprepared listener, hence I have made no special study of Customers' Records and Billing Methods for submission to this Association. I may, however, briefly outline the methods in use by the Company I am connected with:

The Montreal Light, Heat & Power Consolidated supplies gas and electric services to a community of upwards 800,000 souls. All gas and electric customres' records are unified and kept on forms common to both services in our Customers' Records Bureau, in our Billing Department and in our Collection Department, such as on contract forms, service record cards, billing and meter sheets, bill forms, ledger sheets, income sheets, etc.

Inspection and Meter Reading Services: Meters are read bi-monthly and meter readings taken are transcribed by meter readers direct on billing sheets while in customers' premises; meter reading operations are continuous and performed under territorial divisions.

Pick-Up Readings: A morning repeat call is made by regular meter readers on the morning following the first call and the readings which are still left over are followed up by district Inspectors.

Printing of Bill-Heads and Stubs:—Bill-heads and annexed coupons are printed through addressograph plates while meter books are out being read.

Issue of Bills to Customers:—Bills are immediately computed after the surrounding of meter books by meter readers without any intermediary process whatsoever, and the readings taken on customers' premises are directly transcribed to bill forms through the medium of billing machines (Ellis type) through which the bill is entirely completed.

Comptometer Check of Customers' Bills:—The extensions appearing on bills are next verified through the medium of Comptometer machines (Burroughs type).

Computing Income and Statistical Information:—The various items of income of record on customers' bills with consumption of services are next distributed on data sheets through adding machines (Burroughs type).

Debiting of Customers' Bills in Ledger Accounts:—Bills are debited against ledger accounts through ledger debiting machines (Burroughs type).

Audits of Debits:—Ledger debits are proved en bloc by a comparison of the totals appearing on data sheets versus those appearing on the tapes of the ledger debiting machines.

Hand entered debits are individually audited on ledger sheets through the medium of income sheets.

Delivery of Bills to Customers:—Bills, with the exception of a very limited quantity which are mailed out, are delivered to our clients by our delivery men.

Receiving Payment of Bills:—The payment of customers' bills is acknowledged through automatic voucher cutter cash registers (National type) and cash changing machines (Brandt type) are used in connection with cash registers.

Distribution of Cash:—Coupons of customers' bills are grouped. sorted in ledger and folio order and fastened together through hand stitching machines (Bostitch type) and they are machine distributed on cash sheets through adding machines (Burroughs type) and proved in groups with cash register tapes and cash remitted to General Cashier.

Posting of Coupons to the Credit of Ledger Accounts:—Coupons are posted daily to the credit of clients' accounts through dating stamp impressions made to appear in credit column opposite debit items.

Audit of Credits:-The posting of credits to ledger accounts are individually audited on ledger sheets through the medium of cash control sheets.

Ledger Balancing System:—A continuous ledger balancing system is in vogue whereby upwards of 300 customers' Ledgers

are kept balanced without stopping or interfering with current operations.

Collection Notices to Defaulters:—Collection notices to defaulters are issued by typists direct from ledger accounts. The duplicates of these notices are taken out by collectors at a later date whenever a remittance does not follow the issue of such and the triplicates are retained by the Collection Suprintendent for control and follow-up purposes.

There are no notices of any shape or form forwarded by ledger keepers to Collection Department as regards arrears.

Comments:—It is our impression that our system is simple and fairly free from duplication and repetition. There are numerous other details inherent to modern billing, collection and Customers' records methods in a public service corporation of our character which are too intricate to enumerate at this late hour and as an impromptu talk altogther unexpected. I shall willingly answer any query.

Thanks for your kind attention.

Chairman: Thank you, Mr. Beaudin. This subject, Customers' Records and Billing, is a pretty large one and it is getting late, so I do not think we will go into a discussion of it at this time in the afternoon, so I am not going to ask for any discussion. You have all been very attentive, although I notice several have left, so unless Mr. Schmidt or Mr. Jones has something to offer, I think we will close the meeting.

In closing, I am sure that I express the sentiments of the Accounting Section when I offer our thanks to Mr. Edwards, who came as our specially invited guest to address us as he did on two occasions today, and also to several members of the Accounting Section of the N.E.L.A. including the present Chairman and the past Chairman, and the Chairmen of many of the Committees, who came up here and sat with us this afternoon and contributed so largely by advice and experience to the success of our meeting.

It certainly was very encouraging to those of us who have worked through the past year or eight months since we were organized, and I trust that when another year comes by this section will reciprocate by sending a large representation to the convention of the N.E.L.A.

We had another member of the N.E.L.A. Mr. Walter C. Lang. I think some of you gentlemen who were in New York met Mr. Lang. Mr. Lang is Vice Chairman of the Accounting Section of the N.E.L.A. and a very hard and industrious worker in the cause. I have a letter from him which I will read.

"Dear Mr. Little,

I hate to break a promise and when I told you recently that I would be in Montreal and would attend the Canadian Association's Convention, I fully expected to keep my word. But it seems that Mr. Smith is obliged to be out of town during this period and on account of a pretty heavy rush of work here at the office, both of us cannot be away at the same time.

The prospects of attending your Convention were more than attractive but aside from that phase of it, I wanted to be with you for I know that you have put a lot of work in the Canadian Association's activities, and I wanted to add my presence so as to enlarge the representation from this side of the Border.

I know your meeting will be a huge success and I am very sorry indeed that the Company's business interfered with the Associations activities at this time."

I would like also to express the thanks of the Association especially to Mr. Fred W. Herbert who has also paid a visit to our Section.

MR. JOHNSON:—I would like to have the Accounting Section pass a resolution expressing their thanks to the delegates of the N.E.L.A. who attended this Convention and made the Accounting Section such a success. If I am in order I would like to have a motion made to have this put into the record.

MR. JOHNSTONE:—I beg to second that. It really has been a great pleasure to have these gentlemen here. (Applause.)

CHAIRMAN:—Carried unanimously.

Is there any further business gentlemen? If not we will consider the meeting closed.

SPEECH BY MR. JOHN F. GILCHRIST, AT THE DINNER, THURSDAY EVENING

MR. J. F. GILCHRIST:—Mr. President, ladies and gentlemen: First, speaking for myself and my friends from the United States, let me express my thanks for your hospitality and consideration in permitting me to stand beneath my own flag to speak to you. It seems to me that it is emblematic of the cordiality which always has, and always should, exist between these nations.

It has not been my pleasure to visit Canada very frequently of late. During the war I was fortunate enough, or unfortunate enough, to be connected with the business end of a Canadian shell contract, which took me to Ottawa frequently, and as a result of that experience I feel something as I imagine a man must have felt who went to France, and while there attended the obsequies over one of his legs which he left on French soil. It wasn't a leg

I left in Canada, but it was something quite substantial, and as a result of that shell contract I feel a very great attachment for Canada. (Laughter.)

I have not noticed many changes, but I have heard there is a slight depreciation in Canadian money. However, I had no idea of the extent to which it had depreciated until this morning, before I had heard of your admirable slogan, "Information and informality." In fear that the proper raiment would not be in my room in time for this affair tonight, I wished to tip the valet, and asked him if he had any change, as I had nothing less than a dollar—a U. S. dollar. He said, "No." I gave him the dollar and told him to keep half a dollar and bring me the change. He came back in a few minutes, very hurriedly, gave me two coins and departed. I looked at them. One was a Canadian quarter, and one an American 5c piece. Of course, I could not question the intelligence of the young man, nor his honesty, so I was simply forced to believe that an American 5c piece was the equivalent of a Canadian quarter. (Laughter).

I asked your Secretary, Mr. Kon, what I should talk about, and he said, "Just say a few pleasant words about the ladies first, and then talk about anything." Imagine my predicament when I am asked to say something pleasant to the ladies, something like forty minutes after the time the dance should have started and still I have not begun to tell my message. The probable state of the ladies' minds reminded me of the old toast we used to give. You men may have heard it, but here it is. It's to "Woman."

In her gladness she is gladdest when she's glad;
In her sadness she is saddest when he's sad;
But her gladness when she's glad,
Or her sadness when she's sad
Is as nothing to her madness when she's mad. (laughter.)

Now there are different degrees of madness, and olso different kinds; for instance, I heard of a gentleman who encountered a German friend returning from a hunting trip in a rather disconsolate mood, with his gun under his arm.

"Shooting?" he asked the German.

"Yah."

"Shoot anything?"

"I shot my tog."

"Shot your dog? Was he mad?"

"Vell, he vasn't so tamned pleased." (Laughter).

There are two or three things I want to talk to you about, briefly and seriously, which I think are of the greatest importance, and should have the closest attention of the executives in our industry today. There are three things I have set up as hobbies in the last few years, and incidentally, I commend to all you men,

and women, too, that you have your hobbies in this business, because it is a business of romance—it is a business in which you can indulge your hobbies.

First is that question of public relations—the question which is absorbing the attention of all of us—the question which should be given the greatest amount of thought and study—one which should always be in our hearts. It involves not only the education of the public we serve—which it is our privilege to serve—but also the question of the education of our own employees, and I think that of the two, possibly the more difficult one is the education of our own employees, in order that they may understand, first, our position in the community—that we are literally public servants—that the position which we have taken, the business which we have chosen, involves a responsibility of serving, which is very dignified, but which, at the same time must be subservient to the wishes and whims of the people. To get that idea into the heads, and minds, and consciousness of our employees is no small task.

The second thing, and I will pass on quickly from one to the other, is the great movement of customer ownership which is getting so much attention on this side of the Atlantic.

This is a form of public ownership which we should all encourage, and which will, I believe, be the life and safety of the companies which we represent. This kind of public ownership is not the irresponsible, wasteful and distrustful ownership advocated by labour and socialistic propaganda. If your public wants real ownership, they have only to interest themselves in the companies engaged in serving them, and this is the only kind of proper ownership of our public utility corporations, and other great companies, engaged in supplying or satisfying the imperative needs of the people. If the discontented labouring man would work a couple of extra hours a day for a year, and invest the surplus so accumulated in stock in one of the public utility companies in his own community, we would arrive at a system of public ownership of the kind that would put an end to the dissatisfaction which the unsuccessful kind of public ownership occasions, and that is the kind of ownership which may be attained by the extension of what we have called customer ownership. If you could, in your communities, have the satisfaction of knowing that five, ten, fifteen, and perhaps twenty-five per cent of your customers were stockholders in your company, and that they were not only, as a result of that, your friends, but that they were forming a great group of owners who were impressed with the value of your securities, and who would in the future absorb constantly their pro rata share of all new issues of stock, I believe it would give you a comfortable feeling. That is true of this kind of public ownership.

But the third matter which I want to talk about particularly is that of the possibilities of our business, or of a portion of our business—the development of the sale of appliances. This is a matter which, in bringing before you, I feel is almost like "carrying coals to Newcastle." I feel that Canada, with its wealth of water powers and lower priced energy, is way ahead of most sections of the United States where conditions are similar to conditions here. There has as yet been no appreciation of the possibility of this end of the business, nor of the responsibilities which rest on us for its development, not only from the standpoint of our security holders but also from the standpoint of the duty which we as trustees of the electrical supply owe to the public. I find that you are quite advanced in a way, in that you are establishing quotas here in Canada on the basis of a "per residence customer" amount of this kind of business which you should do, and that in many of your companies you are doing an electrical appliance merchandising business of $12.00 to $15.00 per year per residence customer. I have found some instances in isolated cases where electrical appliances to the amount of $20.00, and even $25.00 and $28.00, per year per residence customer are being sold, but in the institution with whose business I am most familiar, our own situation in Chicago, we are only selling some $7.00 or $8.00 worth of merchandise per residence customer annually. We have a population of approximately three millions of people, and at our present rate of sales we will sell somewhere in the neighborhood of four or five million dollars of appliances this year.

As I said before, we are not doing what we should do from the standpoint of our obligation to our shareholders, or from the standpoint of the greater obligation which we owe to the people. I do not think we appreciate the extent to which these new labor-saving devices actually can conserve the health, the strength and the welfare of our constituents. I am not talking in superlatives. It may be that I have worked myself into a state of mind where I think of something that is in the future, and should be left in the future. However, I believe that this is not the case, that this situation is right here with us and should be dealt with now. I believe that if electric labour saving devices will preserve the youth and save the time of a woman, will extend her life five or ten years, and keep her good looks for five, or ten, or fifteen years longer, we are not carrying out our job if we do not extend to the limit all the possibilities of that business, especially when it is considered that we are enjoying a monopoly by consent of the people, and are the only force which has the power to develop the use of these labour-saving devices.

This raises a great many interesting questions. When the

business of selling appliances was small, when we put a few irons and toasters on our shelves, and let the public come in and take them away if they wanted to, and we sold a few hundred, or even a few thousand, dollars worth of them a year, it did not matter very much if we did not know what it cost us to do business. If we were losing anywhere from $10,000.00 to $50,000.00 a year, it was a relatively small matter. We could easily charge that much money to advertising and forget about it. But when we come to do this business as we should, and the losses run as high as they do in some of our companies, it begins to make us sit up and take notice, because it is unpleasant to do business with that amount of loss.

Now the natural question which arises is, what is the trouble? Without going into a great many angles, briefly the truth, as I see it, is that when these devices first came out we were of the impression that any method of getting them on our lines was justified. We would give them away. We used to take fans which we paid $7.00 for, put a plug on them at our own expense, and sell them at $7.50, and we thought we were merchandishing. We got the manufacturers into a position where they thought we were entirely satisfied to sell these devices just for the sake of the increased electricity consumption occasioned by their use, and I think that was our state of mind. Present day practice in the electrical manufacturing business, as you may know, especially in the appliance business, is quite different from what it was in most merchandising businesses. In the case of most of the manufactured goods of the electrical manufacturers, it is the custom of the manufacturers to put an ultimate retail sales price on these goods. That ultimate price does not leave enough spread between cost and selling price. You cannot buy the goods sufficiently below that ultimate price so that you can do business in decent volume and properly serve the community, and at the same time get your share. If you want to sit back and let the people come in for these appliances and take them off your shelves, the way they do most other kinds of merchandise, and are content with that kind of distribution, you could probably make money at the prices which now prevail, but strange as it may seem (and we know there is nothing which goes into a woman's home which she ultimately appreciates more than the washing machine or the vacuum cleaner,) you cannot get her to come down and buy one on the floor of your shop—or at least that is so in the United States. You have got to go and place the appliance. It has got to be sold. The apparatus has got to be put in their houses and tried out. They have got to be waited upon by intelligent men, who must be well paid, and when you get through, the cost of selling the appliances and doing your job, and serving the customer as you should, is such that you can-

not do that kind of business in a big way for less than 37 1-2 to 40 per cent of the selling price of the merchandise.

Now, will you tell me how you can buy goods at 35 per cent discount from the list price, which is usually widely advertised and well known by the public, when your cost of doing business is 37 1-2 or 40 per cent, and you get less than that margin to cover your total expense of making the sale? Perhaps you will not believe that. I did not at first.

The Accounting Section of the National Electric Light Association has done a very good job for us in devising a classification of accounts, by the use of which we are able to keep an accurate and comparable record of merchandise sales and expenses in the larger central station companies doing a merchandising business. We have two committees down in the United States, one in the National Electric Light Association, and one in the Association of Edison Illuminating Cos. known as Merchandising Policy Committees, consisting principally of presidents and vice-presidents of some of our biggest electric utility companies. There are some fifteen or sixteen men on these committees of the calibre of Mr. Edgar of the Boston Company, Mr. Wagner of the Baltimore Company, and Mr. Freeman of the Cincinnati Company. These men are sitting around the table and studying this matter. It is an indication of how important they think it is. Eleven of the companies represented by the men on these committees have gotten their figures on to this classification of accounts, starting from January 1st. I shall not bother you with details, but briefly, these eleven companies did $800,000.00 of business in ninety days, with a loss of about 12 per cent, or about $100,000.00.

That is the answer? It seems a strange thing that the answer to a bigger distribution of anything is to raise the price, but having gotten off on the wrong foot in the electrical appliance business, I see nothing to do except to get right by raising the price. For instance, I think if your government, or ours, should issue an edict, and succeed in getting it lived up to, that no automobile should cost more than $100.00, it would not be very long before automobile manufacturers would go out of business. No one could make them and turn them over to you for $100.00. If they could not be sold for some profit, the manufacturers would go out of business and no one could enjoy automobiles. That is very much the position which we find ourselves in.

This is pretty dry for you ladies and if I may stop short and digress for a moment I would like to tell you a story to liven you up a bit which has no connection with this discourse except that it is a dry story. Mr. Elliot Wadsworth, formerly an electrical man with Stone & Webster and now Assistant Secretary of the Treasury of the United States tells this story. The Treasury De-

partment is charged with the responsibility of enforcing the dry laws, and that Department is deluged with a great deal of abuse and communications of all sorts. He referred to a letter which he had recently received from a man up in Minnesota, who was discussing the tendencies of a certain race of men to import booze across the Canadian line and distribute it in Minneapolis. This was written in poetry as follows:

Ten thousand Jews, importing booze, without the State's permission,
To supply the needs, of a million Swedes, who voted for prohibition. (Laughter).

Now I will go back to the serious part of my talk.

I am coming to you very largely with my problems. Mr. Davies said that he thanks me, or words to that effect, for coming up from Chicago. I am coming up to see if the Canadian people won't take hold of this thing and help. We may be wrong. We may not know anything about our business. We may be making lots of money instead of losing it, but we think we are losing it. I believe, gentlemen, in the central station business, if you were to develop your appliance business to the point that the community requires, say $20.00 or $25.00 per year per residence customer of electrical appliance sales, you would find that the means which you had to take to do that would be such that your costs of merchandising would very much exceed your gross profits, and you would be left not only with no profit, but with a heavy loss.

Now it seems to me that we should get together more closely than we have done with the manufacturers, and the jobbers, and the dealers. First, we should analyze this business very carefully, and determine whether our surmises are correct. Then we should devote our attention very carefully to solving the problem, because until it is solved, the appliance business, which is destined to become a very important branch of our business, will be held back.

The hour is getting late,—you probably would like to listen to other speakers, who it is to be hoped won't talk on such a humdrum subject as I have — but I am laying the matter before you, not only before you men, but before you women, because we are all interested in the public utility business, and we are all interested if there is a possibility of developing a business which will not only give us profits in a merchandising way, but will give us very big profits in a central station way, and we want to develop it. Our sale of kilowatt hours per residence customer in the City of Chicago has doubled in the last fourteen years. Notwithstanding this, we are constantly reaching out for smaller customers. We have reduced our rates somewhat in the meantime, but still our income per customer is at least $4.00 per year higher than it was

fourteen years ago. This is a satisfactory sign, because some of you who are in the gas business, if you are having the same experience as we are, are discovering that as the business gets bigger, you take on smaller customers, and the income per customer grows smaller. The result is that the costs of getting the business, and all the mechanical work which has to be done for the smallest customer at the same cost as the biggest, is taking all the profit out of it, so that in many of the gas companies in the country a very large percenage of their customers are an absolute liability. They are making all their money on the big ones and losing it on the smaller ones. That has been the fear that has haunted us in the electrical business, but our situation seems to be moving in the right direction, and it is almost entirely due to the way in which we have developed the appliance business.

I want to state again the great pleasure I have had in accepting your hospitality in coming to Canada, and I hope I have accomplished something by this very desultory talk, at least I haven't read it—it is from the heart—which reminds me of a story of a Scotch minister (I hope Mr. Allan won't take any offence), who had been offered a new charge in Scotland, and accepted. He preached his first sermon, and after he had finished, a number of the elders gathered around him and told him a certain lady of high birth who lived in the neighborhood had gone out of church, as if she were displeased with the sermon, and they urged him by all means to call upon her and find out what caused her displeasure, and to please, if possible. The parson called at he first opportunity, and found the lady in a very chilly mood. He finally asked her what she was displeased at. She told him she was displeased at his sermon. He asked, "Why?" She said, "In the first place you 'readed' it, in the second place you 'did na' read it owr weel,' and i nthe third place, it was hardly worth the readin.' "

(Laughter).

At that I will retire, renewing my request that you Canadian people get into this thing and help get the electric appliance business on a proper basis. (Applause).

FRIDAY MORNING SESSION, JUNE 22nd, 1923

PRESIDENT:— Gentlemen, I call this meeting to order.

This being a general session, I want to make appointments for the Nominating Committee. I wish to appoint on this Nominating Committee, Messrs. A. Munro Grier, A. A. Dion, J. S. Gould, C. S. Bagg and P. S. Gregory. I ask these gentlemen to discharge their arduous task and bring us in a slate for the coming year, and I appoint Mr. Munro Grier as Chairman.

We have one paper carried over from yesterday—the paper on the Underground Systems, but Mr. Kenyon does not seem to

be present this morning, so we will let this slide for the moment and go on to the Lamp Committee report.

I hope you will show the same enthusiasm in discussion today as was shown yesterday.

I ask Mr. Kintner, Chairman of the Lamp Committee, to present his report. (Applause.)

(See report in Advance Proceedings.)

W. KINTNER:—Mr. Chairman and gentlemen, I won't read over the report, I will just simply give an outline of it.

First is shown an alaysis of lamps and consumption by type for the last year. The number of Type B lamps in proportion showed a slight decrease, and the C lamps, which consume more power, an increase from 16 to 19.7%. This is a pretty large percentage of increase. It means that the lamp sales for Canada are from about 14 millions to 16 millions. Recently in the Journal of the Institute of Electrical Engineers there was a table showing the lamps per capita sold for 1922. On this basis the Canadian lamps per capita is 1.76, based on 15 million lamps in a population of 8 millions five hundred thousand. The U. S. are first with 1.83, Switzerland is next, with 1.62, Germany next .88, England has 45. That gives a kind of interesting table.

We have continued the lamp curve. The prices of lamps of 300 watts and above are the lowest price these particular lamps have been.

Very shortly the Canadian Engineering Standard Association will issue a lamp specification for Canada. That work has been going on for the last two or three years, and the work of the Committee has been practically completed. It is really waiting for approval.

Care of the lamps in use: The Committee thinks that point is very important, as if lamps are not maintained properly there will be a tremendous loss of light on the work planned, or in the room, factory or store, wherever the place may be. The result is that you will consume the power but you are not deriving full benefit.

We also wish to again call your attention to proper voltage regulation. If lamps are burned over your voltage, the lamp user will lose out, because the lamps will not last for nearly as long as they should, and if you burn under voltage, you lose out on the illumination side.

Traffic control. There seems to be some work being done along the use of lamps for controlling traffic, in the larger cities.

The last two or three years there has been a lot of work done in regard to lighting of streets. Tables have been compiled showing the decrease in crime and results of accidents, so the street lighting is increasing in importance. We have listed here a table showing the principal installations in Canada during 1922.

On the new developments, the tipless lamp is now being manufactured. The factories are over on it to a very high percentage, some more than others, but there is a steady curve going over in to the tipless lamp, which needless to say is important, as it removes a vulnerable spot on the lamp. That really is its weakest spot.

Sign and decorative lamps. The 15 watt mill type Mazda sign lamp is a new development. At the present time a 10 watt sign lamp is being made to meet the demand for signs wired up for 10 watt lamps.

Coloured Lamps. Within the last year or so there has been a considerable work done in the development of coloured lamps. showing various colours of lamps, which gives pleasant effects for decorative work. At the recent Shriners' convention in Washington, D. C., about forty thousand lamps similar to these were sold to the Convention for decorative purposes.

PRESIDENT:—They are not dipped?

W. KINTNER: Mr. Davies brings up the point in regard to those lamps being dipped. Those lamps are sprayed. Coloured material is sprayed on them through a spray gun. The lamps are then baked. I have taken some of those white ones, put them on a test rack, and two or three times a day have had those lamps immersed in water. There is no flaking off. The material is on there permanently, and there is none of the fading which we have on the dipped lamps.

People who dip their own lamps in colour may have difficulty in dipping the tipless lamps. When a tipless lamp is dipped and allowed to drain there will be a large drop remaining on the lowest part of the lamp. This large drop will not dry properly and in all probability it will either flake off or give a dark spot. The tip of a tipped lamp serves to act as a drain.

Those lamps, as I say, are weatherproof — the material does not burn off, neither does it flake off. Of course if any oil or grease gets on those lamps, it will apparently fade.

The bake oven lamp is another new development. There is some demand for bake ovens and annealing ovens in places where there is a fairly high temperature. They are supposed to operate satisfactorily at maximum temperatures of 250 degrees Centigrade.

Another development is the highway lighting units. We have shown the two types which have been developed within the last year or two, which provides a clear view of the whole read for a considerable distance ahead, which I think for automobiling people is of importance.

Also this type of Highway Lighting Unit, when properly installed, practically eliminates glare.

The next one may be more important—the elimination of glaring lights within the range of vision. We have shown separate curves. The principal point in these particular types of lamps is to have the light on the road, either way, and minimum light on the side of the road where it does no good.

Next is a table showing a list of articles on subjects pertaining to illumination. There is considerable information written in various technical magazines and also the lamp manufacturers publish considerable information. As a result this information is more or less scattered. If an architect wants to look up the latest information with regard to church or store lighting he may be at a loss where to look for the various information on that particular subject. The articles are listed under different subjects such as residence lighting, industrial lighting, sign lighting and so forth.

On that tabulation I would like to have some views as to whether or not the information is worth being compiled in the future reports.

That ends the comments on the report itself. Mr. Dion recently brought up the proposition of standardization of voltage in Canada. I might say that approximately 91% of the lamps sold in Canada are with standard voltage, namely 110, 115 and 120 volt lamps. In the States, in 1922, the percentage of those standard voltage lamps was 88.2 so from the voltage standardization standpoint Canada compares very favourably.

In last year's meeting the Committee called to the attention of the Association the fact that there was no Canadian Lighting Code or any Canadian information. Under date March 28th Mr. Kon, our Secretary, asked me to prepare reports showing just how far things had progressed in the States, as well as Canada. So this special report shows the purpose of the lighting code. I have outlined the American code, from which you can get a very good idea as to the ground covered. The American code is divided into three parts. Part 1 deals with illumination, and gives a table on minimum requirements. It also deals with avoidance of glare. Part 2 deals with suggestions and general information, giving a table on desired foot candles. It deals with illumination, location of switches and controls, causes of glare, dealing with lighting from the glare standpoint, and general comments. Part 3 deals with the advantages of good illumination, which need not be gone into.

Next is given list of the American States at the present time using the lighting code, there being nine of them—Pennsylvania, New Jersey, Michigan, Wisconsin, Oregon, California, Omaha, Oklahoma and Massachusetts.

Next is given the information in regard to the States which

are working on a code, which are Washington, Colorado, Utah, West Virginia and Texas.

Next is given information in regard to the enforcement of the industrial lighting code in New York, which shows that the matter has been taken up with the various people and certain orders have been issued, and over 90% of those orders have been complied with.

Next is given the addresses of the people where the various State lighting codes may be obtained.

In regard to Canada, so far as I have been able to find out, and I have asked a good many people, there is no lighting code for Canada and I certainly think some steps should be taken along those lines. (applause)

PRESIDENT:—Thank you very much, Mr. Kinter.

This is a very valuable report indeed we have been listening to. What is very interesting to me is the fact that there should be an interest on the part of regulatory bodies in such matters as glare. I am sure if we could get our State regulatory bodies in Canada to be interested in the matter of good illumination in such a way that they would insist upon a certain standard of illumination, it would be a very good thing for us, besides being a very good thing for the employees of the different concerns.

I would like to get some discussion on this paper, and call upon you to state your name and affiliation before opening any discussion. Have you any difficulty in hearing me at the back?

Well, gentlemen, I would like to have some discussion on this valuable report.

JOHN MURPHY: Mr. President, if any regulatory body in the Province of Quebec has anything to do with glare, the point to be submitted to them first, in my opinion, was illustrated last night at the dinner. I unscrewed the lamp that was shining in my eyes, and within five minutes nearly all the lamps in the Hall were unscrewed and put out.

PRESIDENT: Mr. Murphy, I thought of that the minute I saw it, but the boys had worked so hard getting it together, I thought it would be unfair to make any suggestions. I think they worked well indeed to make that dinner something unique from the lighting point of view, and while, of course, the glare was there, the effect was worth the glare.

Any other discussion, gentlemen?

Once a year we meet and have the opportunity of discussing such matters as this, and if anybody has any question to ask, even the simplest question, now is the time to ask it. I have said before, and mentioned in my speech, we must not forget that the younger men in the industry do not know all the things some of the older men are supposed to know. The only method they have

of improving their education is by listening to some of us talk from time to time. Therefore, if any of our younger members have any points in mind that they want illustrated, now is the time to ask them.

GEO. D. MCDOUGALL:—I am very sorry I wasn't at the dinner last night, though I have just heard about this lighting demonstration. It seems to me that at a meeting of an Association like this ours, some care should be taken as to the effect of what we do is going to have on the guests present. If they come in and see the kind of a demonstration we had last night they are going to get it into their heads that it is the proper thing.

Another thing, the power companies (I used to be in the power business but am not now, so I can talk a little bit) are inclined first to sell current for load purposes and not for lighting. if you sell lighting you will sell the current all right, and you will get more satisfied consumers, and also educate the public. It is really up to the public utility to educate the public as much as possible in the way of lighting. All you have to do is to walk down one of our main thoroughfares and see the most terrible window lighting. Go into our factories. In factories and works that are supposed to be entirely up-to-date, they have often the worst lighting installations you could imagine. You cannot tell them anything, because they say that they have been getting on all right that way and they don't see why they should change. The public utility is really in the best position to educate them, but it costs a little money to do it. A consulting engineer cannot go in and spend hours trying to educate them, and then get a job that they want to pay him $50 for, after he has worked for weeks. So it seems to me that the education has got to come to a great extent from the public utilities. I believe that in Chicago they have done a great deal along these lines and the amount of current consumed has been very greatly increased. From the point of view of the consulting engineer, I have never seen yet the installation that we have not been sorry afterwards that we had not hoisted up the value of the illumination a little higher. The consumer seems to think his bills are terrific when he first starts, but in a very short time he realizes that there is a saving in having a high values of illumination, but it must be illumination not only light.

PRESIDENT:—Thank you, Mr. McDougall. I see Mr. O'Brien in the room. He is the Chairman of our Commercial Section. I will ask him to step to the front and take a seat.

I do not know whether this is an opportunely time to go into the discussion of lighting and illumination as a whole. We have one or two other papers, and a lecture by Mr. Luckiesh, and so I don't know whether we should discuss it at the moment or pass on. The arrangement of the programme is such that the next matter

is really not related, but we return to lighting again, and I think that we might allow discussion to come later. At the same time if there are any specific matters in connection with this report of the Lamp Committee that appeal to anybody, I would like to discuss them now.

E. A. STRANGER: I would like to know if the tendency in the construction of lamps is moving to higher voltages for the ordinary incandescent house lighting lamp, somewhat along the lines of the 220 volt lamps in use in England and Europe today.

W. KINTNER: I certainly hope not.

PRESIDENT: Of course, Mr. Kirtner, that may be the lamp manufacturers' point of view, but we must remember that at the New York Convention one of the speakers (I have just forgotten who it was) came out very flat footed for the increase in the voltage on secondary distribution to 220-440. He explained the fact that there was 700 tons of copper in one square mile of New York's underground system. This could be cut to one-quarter of that amount if the voltage was doubled. It is only on this side that we are still revolving around 110 volt standard. I do not know of any installations in Canada where they are using 220 volts for lighting as a steady voltage, but possibly there are some.

W. KIRTNER: I know there are a few installations using 220 in Canada, and in England 80% of the lamps sold are the 220 volt grade. I have seen British specifications, and their efficiencies are remarkably low. I do not know the exact reason—I have never been able to find out, but the efficiencies are low. We certainly cannot make the 220 volt lamp nearly as efficient as the 110 volt grade of lamp. The manufacturing difficulties are tremendously increased, and the cost of the 220 volt lamp is more than that of the 110. The loss on the manufacturing floor is also more. The filament in 220 volt lamps is closer together, which increases the possibilities of the filament interlocking. I will admit there is an advantage from the copper standpoint. You don't have to put in so much copper. I certainly wouldn't like to see any tendency at all to go over to the 220 volt lighting circuits. Although you would save the copper you would have to increase your power consumption. I am not in favour of it.

E. A. STRANGER: What I have in mind is the fact that all power companies are trying to build up appliance loads. We are coming to that point you raised, of the tremendous copper investment to serve these appliance loads. If they can be served by means of higher voltage, it would be better for all concerned, not only for the power company, but for the consumer, as he is the man who pays for the cost in the end, one way or another, and I really wanted to bring out whether there was any development work being done in the higher voltage lamps which would allow

distribution of power to the house circuit at higher secondary voltage.

W. KINTER: There is no development on the lamp end to meet any conditions of that kind. The demand for 220 volt lamps is diminishing year by year. I will get this figure. I know it is diminishing from year to year.

PRESIDENT: We have got a problem ahead of us, no doubt, about secondary distributions. I hope the solution will be the one I suggested yesterday, which was customer supplying the transformer and the Company supplying 2,200 volts.

The English practice is occasioned by the fact that their distribution is entirely under ground, and the fact that they run DC in most cases, and naturally they start out 220 440 from the power station. If they attempted to distribute 110 volts direct current from one station, why the copper required would be an impossible amount.

Any other discussion of Mr Kinter's report, or the report of the Lamp Committee? If not we will pass on to the next report, — the report of the Relations with Customers Committee, Mr. H. T. Anscombe, Chairman.

Pardon me, Mr. Anscombe, but owing to pressure yesterday, we had to omit the report of the Chairman of the Commercial Section, and I now want to remedy that omission and ask you to listen to Mr. O'Brien's general report upon the activities of the Commercial Section.

M. O'Brien, the Chairman, will address you.

W. O'BRIEN: The activities of the Commercial Section during the Association Year 1922-1923 have been carried on through the medium of four Bureaus as follows: —

Power Sales Bureau —Chairman Mr. D. M. Gall —Montreal.

Merchandise Sales Bureau—Chairman Mr. Geo. Atchison —Montreal.

Lighting Sales Bureau—Chairman Mr. J. H. O'Hara —Ottawa.

Customer Relations Committee — Chairman Mr. H. T. Anscombe—Ottawa.

A departure from the usual practice in the appointment of members to these committees this year was made in that representatives of manufacturers of electrical equipment were named to act with the usual central station or utility representatives.

Deep appreciation is felt for the benefit of their experience and advice in matters pertaining to electrical equipment brought into the discussions of their various committees.

An individual report of these various committees has been printed in the Advance Proceedings. The subjects dealt with therein are of an important, as well as of an interesting character.

and it is sincerely hoped that our delegates take full advantage of the occasion to thoroughly consider and discuss these subjects in open meeting their doing so will be regarded as a mark of appreciation by the Committee men individually and collectively.

POWER SALES BUREAU:

Important features of the Power Sales Bureau report are:—
Industrial Electrical Heating
Standardization of Power Contract Conditions.

Your attention is particularly drawn to the draft of the power contract conditions as submitted, and it is recommended that Member Companies might seriously consider the adoption of the various clauses as the basis of a power contract. In the formation of these various clauses concentration of effort was centered on the safeguarding of the interest of the Supply Company and the Consumer with the objective of providing equitable treatment for both parties. Uniformity of power contract regulations should tend to create a favorable impression in the minds of consumers throughout the country.

LIGHTING SALES BUREAU:

The Lighting Sales Bureau will not make their report in technical form, but instead has been fortunate in securing leading illuminating engineers to give illustrative lectures on the lighting of the home, industrial lighting, shop window lighting, street and highway lighting, at this Convention. Full attendance and close attention at these lectures is desired and will be deeply appreciated by these experts, and furthermore these lectures are of a highly educative character.

MERCHANDISE SALES BUREAU:

An exhaustive report will be presented to you by the Merchandise Sales Bureau which during the past year has given considerable time and effort to this work. The subject of merchandising is becoming more and more vital to all branches of the electrical industry. The Bureau has delved into the subject of advertising of electrical appliances, and the best method of bringing the comfort and conveniences of such appliances directly to the attention of the public.

CUSTOMER RELATIONS COMMITTEE

The Chaiman of the Customer Relations Committee will submit to you a report on this subject which is pregnant with suggestions and advice which are strongly recommended to our Member Companies for adoption. SERVICE is the predominating feature.

Hydro-electric power development on a large scale, throughout the country from the Far West to the Maritimes is being carried through (or projected) at the present time. Therein we visualize the strong position of hydro-electric enterprises sustained throughout recent years of trade depression reflected in the public confidence in the securities of these organizations bringing about the developments which are now in progress or projective.

Service has brought our enterprises into this enviable place in the public mind. Commercial men in the public utility are in primary contact with the public. With these men, in co-operation with the other departments of the utility, lays the task of holding and strengthening the confidence reposed in hydro-electric enterprises.

E. S. Edgar
R. B. Cockburn
E. C. McGovern
K. A. McIntyre
J. H. O'Hara
G. B. Atchison
P. R. Labelle
W. P. O'Brien, *Chairman*

President: In a sense the Commercial Section has been my pet this year, as well as Mr. O'Brien's. As I mentioned at the dinner last night, there has been criticism in the past about the fact that the technical end of our Association seemed to be the predominating end. We have endeavoured to remedy it this year, by stressing more the work that is done by our Commercial Departments, and under Mr. O'Brien's guidance the Commercial Section has done wonderfully well this year.

I would like to move the adoption of Mr. O'Brien's general report, if it is your pleasure, gentlemen. (applause)

Thank you.

I will call upon Mr. Anscombe to present his report — the report of Relations with Customers. (applause)

(See Report in Advance Proceedings)

H. I. Anscombe:—This is going to be extremely short. It is hardly necessary to read this paper, but I would like once more to impress upon the members of the Association one particular point. Even if you have heard it hundreds of times before, repetition will do no harm. That is, the importance of making sure that those who come into contact with the public, the rank and file—if I may use the expression, are so grounded and schooled in the policy of the Company towards its customers, that they in their actual dealings with the public will reflect that policy. Unless this is done you might as well consider the money you spend on

good will publicity as just that much money thrown away. I think if you will consider that and work on it, that the work of this Committee will not be lost.

PRESIDENT:—Thank you, Mr. Anscombe.

That report, gentlemen, is found upon page 99 of the Advance Proceedings. I would like to know whether there is any discussion on this report. There has been lots of good stuff coming out monthly in the NELA Service Bulletins that is very interesting. Of course you all get copies of them. Mr. O'Brien, I think, will say a word for us.

W.O 'BRIEN:—There are some points brought out by this report, principally the co-operative effort of the electric homes throughout the country. It seems to be a very good idea, and I would like to know if any of our people have taken up that idea in the other Provinces. We in Quebec have had our Electric Co-operative Association operating for some time back, with good success, and we know there are some other Associations of a similar character. If there are any people here who have anything to do with such Associations in the other Provinces, we would like to hear from them, to see what their activities have been towards the education of the public, and matters in general in connection with public utility service.

PRESIDENT:—I know they have had various electric homes right across the Continent. I know of two or three in Toronto. I think they had one or two in Hamilton. Really a wonderful work has been done in these electrical homes. Mr. Kon knows more about the Montreal end of it than anybody. I wish he would say a word about it.

W. O'BRIEN:—As regards the electric home in Montreal, we have run two. The last home we had about fifteen thousand visiters, I think it was. The one before that I think we had possibly the same number. We ran the second of these off last year. One example of the outcome of those homes is, that formerly probably about $50 would be spent in electric wiring of the ordinary house, and through the education that has gone on with the builders, etc., that sum has been increased very considerably. Some of the better class homes being erected are having as much as a couple of hundred dollars spent on the electric wiring, to provide facilities for people to employ electric appliances in a proper manner. The establishment of the electric home in turn provides considerable work for contractors, this in turn going back to the manufacturer and public utility. We all benefit by it.

PRESIDENT:—Have you any idea as to the increase in the number of KWHs used by these homes that have been wired up somewhere over 30%?

W. O'Brien: It is probably a little early in the day to note that very considerably, but I should say there ought to be 30% increase in ordinary household consumption. That is probably a rough guess, but it is not very far off. It is a little early to notice the increase of our consumption through provision of conveniences to use appliances.

President: Well, gentlemen, if there is no more discussion, I move the adoption of this report in the usual way. (applause)

I have now much pleasure in introducing to you Mr. L. Luckiesh, of the NELA Research Laboratories. Mr. Luckiesh is the first and last word today upon illumination of the home. Mr. Luckiesh, I think, must be the most prolific writer on this subject that has ever been presented to our world to date, and the versatility of the matters upon which he touches, and has touched, is, I can only repeat the word, extraordinary. I hope he won't feel bashful after this introduction, but I have no hesitation at all in stating that our Association, in having him here today, is indeed fortunate. I think after you have finished hearing my talk and seen his demonstration, we will all be glad we came to this meeting this morning. (applause).

M. Luckiesh: Mr. Chairman and gentlemen: In my preparations to discuss the subject of residence lighting here, I thought it would be best to base my remarks upon my recent N. E. L. A. Report. That report deals with conditions in the United States, chiefly the results of a survey of residence lighting and all its possibilities. I feel, however, that whatever is true of the United States is true here in the way of commercial possibilities in residence lighting.

Residence lighting to me was originally just a hobby along with my regular work. I got to thinking one day about how the electric business began in the home, and yet how we allowed the field of residence lighting to drift along by itself. There was no detailed study of the subject, and we began it, feeling that we happened to have some of the qualifications required for developing that field, because it is far from being solely an engineering job. It is a combination of science and art, we might say, and it has been interesting analyzing and developing the field. This last report presents much new material, which shows us the possibilities. I would suggest that those of you who are interested in new business get a copy of this report, if you have not already secured a copy. They can be obtained from the Headquarters of the National Electrial Light Association, New York City.

On the first inside page we made some estimates — in fact, they are more than estimates — of the new business available in residence lighting in the United States. The figures run up to billions of dollars.

When I start to talk about a subject like this, I feel like the clergyman who put his whole heart into delivering what he thought was an excellent sermon against atheism. After the service he felt that he had done a pretty good job of it, and he wanted to get a compliment or two, so he asked one of the congregation how he liked the sermon. This person replied: "Well, it probably was a good sermon, and maybe it was all true. At least, you said it cleverly, but I still believe there is a God." (laughter)

I believe it was Mr. Pike last night who said that the scientists and engineers were away ahead of the commercial men, I think the reason is that we pay the price of concentration and study. I have learned a great deal talking to salesmen. They are hiding behind a smoke screen of a naturally growing business, and claiming credit for the natural growth. If every commercial man would sit down and do nothing, the business would still grow. The job of the commercial people is to sell in ten years that which would normally be sold by itself in one hundred years. But at present they are sitting behind that smoke screen and taking to themselves a lot of credit for something that does not belong to them at all. What we want is more than more business. I would like to see all the reports and data include the business last year; what it ordinarily would be this year without any effort, and then what it really is. I would like to see the last figure higher than the previous figure. I think if we would get that point in our minds, we would keep on our toes. If everybody would get the fact that the electric business is a growing thing in spite of our commercial men, they would have to hustle some to hold their job.

There is no residence lighting and wiring problem that comes up that we cannot find something about in this last N. E. L. A. Report. It shows all the vulnerable points in getting lighting business, and by lighting we mean not only lamps or current, but also fixtures, wiring, and portable lamps. All interests should work together in order to prosper together.

The second section of the report is something we have been working on — standardization of simple receipes. One of the greatest difficulties we have in developing residence lighting is that people living in homes think they are experts in wiring the homes.

(Mr. Luckiesh carried on from here with illustrated lecture of commercial possibilities of residence lighting).

PRESIDENT:—Gentlemen, before proceeding to a formal vote of thanks, I have no doubt some of you would like to ask Mr. Luckiesh questions. Our time is becoming short, so I would ask you to be brief and prompt.

W. O'Brien:—I am sure we are very much indebted to Mr. Luckiesh for this highly educational paper. After listening to this and receiving its educational value, the thought strikes me — how are we going to apply the knowledge that we gain today? Whose job is it to put it over to the public? I think there are others besides the public utilities whose job this is. I do not think it is purely the public utilities' job alone. It is a big job indeed. How are we going to accomplish it and improve the load factor?

We attempted this in Montreal through a Co-operative Association, in which we had utilities, manufacturers and contract dealers, and others connected with the electrical business, through the means of electrical homes. We had the pamphlet issued by the NELA on the "Comforts and Conveniences for Electricity in the Home" printed in the dual languages, for every home that is planned the contractor or owner, if known, a copy was sent to him. We are doing our best to try and educate the public to the proper use of electricity, and the comforts and conveniences attributed thereto. But it is a big job, and not a job alone for the utilities, — it is a job, I think, in which the manufacturers and contractor dealers are as highly interested in as the utilities. Through the medium of co-operative associations seems to be the only way to work this out — with electrical homes, demonstrations, etc. Perhaps Mr. Luckiesh might give us a little advice on the subject. Is it for one branch of the industry or profession to take this in hand, or is it not an undertaking in which everybody is interested?

L. Luckiesh: I think Mr. O'Brien is of course quite correct. It isn't the public utilities' job alone. I will say, answering from the United States viewpoint, there are a lot of central station companies who have not done their part as yet. Of course I want to say my job ends here. It is up to you to apply the information, but let us look at the lamp manufacturers' advertising for the last two or three years. It has been exactly along this line — pretty good high grade advertising that takes different rooms and lights them properly. That is one item. The Illuminating Glassware Guild, an organization in the United States of glassware manufacturers, has been organized for several years now, and is doing good work. They are starting some co-operative advertising now. The fixture manufacturers have been getting together more and more. They are our weakest link yet, but they are getting together and improving right along, and are holding meetings. In Cleveland, as I mentioned, the Electrical League organized the various interests. I think it is a job that has got to be divided up, and the more enterprising are doing it in the United States. There are certain large jobbers that have illuminating men who are doing good work, but the fixture manufacturers have not yet

done much to put over good lighting. They are still selling fixtures, and are doing little along the line of good lighting. The Illuminating Engineering Society in the United States is trying to do its part, and could do more if it could branch out more in a commercial way. It is just a matter of preaching the gospel and everybody doing his share, without waiting for the other fellow to do it. Progress has got to be made through commercial channels. Nothing was ever done that did not progress through commercial channels. It is the commercial channel that really is the contact, and all of the interests have got to do their part and not leave it entirely to the central station. I do want to say that some central stations in the United States have done a wonderful lot of educational work, and some have done very little.

MR. CARTMEL:—I suppose I am out of my field here, but I have seen something of lighting too, and I was very glad to be here to hear Mr. Luckiesh, because I know of nobody who could give us such a good story about lighting the home as Mr. Luckiesh can.

I want to ask the privilege of just saying a word about another phase of the same subject. I feel so inspired by what Mr. Luckiesh has said about home lighting, that I think more attention should be called here to the deplorable state of affairs as regards general public lighting. It is also of importance, as well as the lighting of the homes. Of course everybody likes to have his own home well lighted, and many people will go to the expense of doing a really good job in lighting their homes, even though the public buildings are badly lighted. In particular there is one little society in this City, which is so badly lighted, that I cannot read any magazines in the society's reading room, so I buy what magazines I need. The thought occurs to me that in a Province like Quebec, where there is so much water power available, and where we are supplied with electric power at such a small rate, that the power companies must be, well I might say almost dead, not to do something about stimulating some of these people to give us a little light.

Mr. Luckiesh put it very nicely when he said that we were progressing so in the electrical industry that without anybody pushing the matter, it would go along very nicely, but it was up to us to do as much in ten years as would be accomplished in one hundred, if things were left to themselves. That is the thought I want to put across. Thank you. (applause.)

PRESIDENT:—Thank you.

Now gentlemen, Mr. Cartmel's criticism is well directed—there is no doubt about it. Mr. Luckiesh, in referring to the smoke screen, also told the truth. It is pretty hard to dispute the normal increase in business, but the tendency of the commercial

end, to which I belong, is invariably to take credit for everything that comes on, neglecting the fact that there is such a thing as normal increase.

One is amazed when one sees what has been done. One of the most amazing things I have heard was that installation of 2,000 foot candles in a window in Chicago. We think if we get 10 or 15 foot candles in a show window we are doing well. They go ahead and put in 2,000 foot candles in a window. We thus see the enormous possibility for development. The Chicago people claim they can thus increase the pulling power of windows. We are very far behind in pushing this business along. I am afraid in this Province of Quebec the contractor dealer today is hardly well enough educated to stand the burden of selling better lighting to our ordinary residents or store customers.

I would like to get some more discussion.

DR. CARR: I would like to ask a question. The speaker said that one-third of the homes in the United States were wired. Now, if you eliminate all the homes that could not get electric current, if they were wired, could you give us the percentage? Presumably it would be very much greater — that is, if you eliminate the country homes in villages where they have not electric current — farm houses and so on — which are evidently included in your figure.

PRESIDENT:—Mr. Luckiesh will answer all questions in a comprehensive way at the end of such questions.

Any more questions, gentlemen? We have some very good fixture manufacturers here. I am sure they might be glad to ask a question or two.

C. JOHNSTONE: I don't want to ask any question, but to draw attention to a point that struck me in Mr. Luckiesh's talk. Unless I mistook him, he said one of he important ways of getting the idea of illumination across was through the electric homes, and that in the case of electric homes the fault was in many cases to exaggerate. I have recollection of visiting the electrical home up at Cote de Neiges Road (I did not see the one in Notre Dame de Grace). I am not an illuminating man, but it struck me when I left that home, that we had been guilty of exaggerating to a very great degree, inasmuch as, of course, the home was a small one, but they seemed to have shoved in nearly every conceivable electrical device. It struck me as if we were trying to show in a small place what electricity could do, rather than induce the people into lighting their homes properly, and equipping their homes suitably and well in an electric way. My object in mentioning it is to draw attention of those who are more directly in the erection of those electrical homes to the point in order to see if they themselves do not realize that they may have exaggerated somewhat

PRESIDENT:—Gentlemen, any more discussion? If not, I will ask Mr. Luckiesh to answer the questions that have been submitted.

L. LUCKEISH:—One gentleman brought up the matter of public lighting. I am glad he reminded me of that. I neglected to say the principles behind residence lighting are the same as apply to one-half of our lighting, and these principles of the home can be extended to restaurants, hotels, some shops and stores, club-rooms, etc., and so when I talk of residence lighting, I am generally thinking of what I consider about half the field in lighting, involving those other places where we live apart from our working hours. And the same gentleman's remarks reminded me of the point of how little people know how to use light and their eyes. We have got to educate people along that line, as they do know how to use their eyes. It is surprising how many people will read in the wrong light, when by turning their chair they might be able to read properly. There is an enormous amount of educational work to be done.

When we go into the stores and shops, there we can justify more elaborate systems of lighting. The other day we laid out an installation in a room 106 ft. long x 75 ft. wide — a room somewhat larger than this, but we put 75 KW of lamps in that room, besides the lighting necessary for pure utility. That is what we can do with lighting. The possibilities in that direction are immense.

I consider artificial lighting the easiest thing to sell, if you sell it in a big way. It is the thing that is going to help make it possible to own all the automobiles we are owning today. We have that investment, and must reduce costs in some other way. A lot of labor and capital that went into the building of automobiles used to go into raising potatoes. Naturally the cost of living goes up. It is purely a simple problem in economics. We consider artificial lighting properly done will increase production, reduce overhead, etc. Light makes two and three shift days possible. Better lighting has been well proven to increase production. In our congested cities we have reached the day of windowless buildings, because artificial light is superior and cheaper.

One gentleman asked for the total number of homes. I did try to carry through all those figures in terms of the wired homes, and then also in terms of the total homes. To answer that question specifically, in the United States somewhat more than one-half of all homes are within easy reach today of electric service. I do not believe there are many houses in Cleveland that are not wired. In some places the effort has been very great in that direction, but probably one-third of the total homes within easy reach of electric service are not wired even today.

Another gentleman mentioned that the so-called Electrical Homes were exaggerated somewhat, and he thought that the one here was. I think that it is a very vital question. Our object should be to wire and equip these homes with fixtures, portable lamps, appliances, etc. not beyond the extent which we can justify and be willing to buy ourselves. Visitors will come in and say "It is ridiculous to put this refrigerating plant in this little home," and they are right. A simpler layout would do the job for us just as well, without inviting that antagonism. I think this is really important.

One feature about the Electrical Homes that pays very well is a demonstrator in every one of the important rooms — one in the kitchen, dining-room, living-room, and one upstairs in each bedroom. Each one is trained to tell the story of that particular room. Now, in telling that story, each one emphasizes convenience outlets, and it is better received than if the same person demonstrated all rooms, repeating convenience outlets from room to room. Each one repeats the story, bringing in the idea of convenience outlets. It goes better with the people and has been very successful in Cleveland. (applause)

President: —I would ask Mr. John Murphy, of Ottawa, to propose a vote of thanks to Mr. Luckiesh.

John Murphy:—Mr. President and gentlemen: Mr. Luckiesh has given us such a complete and convincing story of how electric lighting ought to be done, that I have nothing more to say, but simply to ask you to join me in giving him a most hearty vote of thanks. (applause)

President: Gentlemen, as I said, we are going to depart from our programme and have our Industrial Lighting talk this afternoon.

I am now going to call on Mr. Jenkins, from Chicago, to address us shortly, first of all imploring him to let us get away by 12:30. (applause).

Fred R. Jenkins:—Mr. Chairman and Gentlemen: I know you all thoroughly appreciate the very interesting educational talk by Mr. Luckiesh. We in Chicago have followed Mr. Luckiesh and have taken advantage of his experience and study of the lighting business, and I can recommend that you can safely follow him. I am quite sure that the results will be as satisfactory as they are with us.

I am going to take a few minutes of your valuable time in talking to you on education. Mr. Luckiesh in the talk on lighting has given you a very interesting educational lecture. We have in our various courses published by the Association lessons along similar lines as discussed by him.

The Canadian Electrical Association as well as the National Electric Light Association stand primarily and fundamentally for education. That, you can say, is the principal cause for their existence. The N. E. L. A. has a Committee on Education primarily for the purpose of aiding in the training and education of employees of our member companies. These employees need and want education. Unfortunately in a great many of the companies the employees who have been in the business twenty or thirty years do not appreciate this fact, possibly for the reason that they have not given it sufficient thought and do not appreciate that the business has grown and developed to such an extent that the junior in the business cannot get the necessary education and training that they acquired over a short period.

Necessarily a young man going into the business today is an entirely different proposition than that of a man going into the business twenty or thirty years ago. In those times, as some of the executives here know, you were all in the same room with the Commercial, Operating, and Engineering Departments, and necessarily had to learn the business. As it is now a man going into a large company of from 2,00 to 7,500 employees necessarily goes into some standardized job in one department, and it would take a great many years to learn the business in the manner that the older men have learned it.

Therefore in order to give a broader view and a knowledge of the various branches of the business the committee publishes up-to date information in the form of home study or correspondence courses, which have proved very profitable investments for the member companies. Day before yesterday the Accounting Education Committee had a meeting here, and I will just touch on what they are planning to do. The committee has laid out for itself this year a very large job. We have thirty-six lessons in Advanced Accounting specializing in the electric utility business. Of this course the first edition has been exhausted, and between now and September we have laid our plans to revise every lesson, bringing them into conformity with the Standard Classification of Accounts and up to the last minute on accounting practices. During the summer and next fall we are also revising the Commercial Courses.

Perhaps at this time I had better mention the courses we are publishing: Elementary and Advanced Accounting Courses for the Accounting Section. We also have for the Commercial Section a Course in Practical Electricity which every young man should take regardless of the department in which he is working. There are also standard courses in Merchandise Sales, Power Sales (These are along the lines discussed at to-day's meeting). These courses are published and sold at prices that outside of an Association would be ridiculous. The reason for that is that the services in

the preparation are largely donated, and we have the services of men who if they were outsiders we could not get for thousands of dollars in the preparation of these courses. The prices are about one-fifth of what you would get the same courses for in the open market, and they specialize in your business. I would like to drive one thought home. How can we expect to grow and progress rapidly in this business unless we start to educate and train the young and continue the training of the older men in the business. By using these courses you will find that this problem is pretty well covered.

It is said that a man is judged by the company he keeps. Now, I think that this applies equally well the other way, that the company is judged by the men it keeps. The value of these courses outside of their economic and financial value have very commendable features. For instance, we know that they promote the best public relations, first class and economical service, and they also promote the best employee relations. This naturally follows when you take up a proposition of this kind with your employees.

President Frank W. Smith during the past year took an extraordinary interest in these Educational Courses, as you may know from those who have taken them. Also he offered an annual prize of $100.00. This prize went to a young man employed in the Boston Edison Company, who was a member of the Commercial Section and took an Accounting Course.

We must not look upon these courses as an expense. These courses are not an expense. They are an investment. There is no better investment that the companies can make (I am now talking to executives) that will pay as large a dividend as training employees, giving them an opportunity to grow in the business and to make many of the short cuts which has taken other men a great many years to acquire. All companies are perfectly willing to invest in plant equipment and to spend their money freely to supply the demand, but the Committee on Education believes that it is as equally important to invest in man power as it is to invest in horsepower. (applause)

PRESIDENT: I would just like to convey the thanks of the meeting to Mr. Jenkins for having spoken about this.

FRIDAY LUNCHEON

MR. A. MUNRO GRIER, Chairman, in his welcome to the visitors, said in part as follows:

When I was recently at the Convention of the National Electric Light Association in New York City, I invited some of the members who attended that Convention to attend the Convention of the Canadian Electrical Association at Montreal. I ventured to observe that whilst there were certain liquid refreshments

which might be had in the Province of Quebec, it was not compulsory to enjoy them, and if any had feelings or views which did not permit of their partaking of them, they were at perfect liberty to refrain. I had the temerity to add that in the Province of Quebec, as in other parts of the world, it was not usual to erect monuments or statues to persons or things until they had passed away, and to observe that in the Province of Quebec there was no statue of Liberty.

Address by

MR. L. A. HAWKINS,

Research Engineer, General Electric Research Laboratories.

For more reasons than one, I feel a certain diffidence in addressing this gathering on the subject of research. Within a few days after accepting your president's invitation to speak I picked up the June issue of the Atlantic Monthly, and saw an article by a Canadian on "The Canadian Viewpoint." I thought "Here may be a chance to get a useful tip, to get a line on the topics in which Canadians are specially interested." So I began to read with care and diligence and this is what I encountered—"The stranger in Canada will receive a hospitable welcome, but——he must be prepared for a period of probation. During this time he will be wise to hold as few opinions as possible, never to express even those, and to show in general little individuality." A bit disconcerting to one who had just undertaken to air his views before a gathering of distinguished Canadians.

But, more seriously, I do feel that it is a bit presumptuous for anyone from the United States to come to Montreal to tell about research. There is no city on this side of the Atlantic that can boast of a university more eminent in research than McGill. The work done at McGill by Rutherford and Soddy I believe ranks in importance second only to that of J. J. Thomson in England in laying the foundation of modern physics. The tradition they brilliantly established at McGill has been ably carried on by others, including Macallam in bio-chemistry and King in phyises. A certain humility is becoming to a stranger who presumes to instruct a Montreal audience in research.

And finally, to say something worth hearing about research is more difficult today than it was twenty or even ten years ago. Then industrial research was a novelty. The large industrial laboratories in the United States though growing in number were still few, and in England there were practically none. Some splendid research work was in progress in university and private laboratories in England but in America there was very little.

Then came the war, and almost at once the world learned to what an extent it had become dependent on the industrial laboratories of Germany. Dyestuffs, medicines, chemical reagents, optical glass, instruments, laboratory supplies, magnesium, special alloys, potash, were among the supplies cut off by the stranglehold of the British fleet. In allied and neutral countries alike chemists and physicists were called from universities into the service of government and of industry to seek to develop the art of producing the equal of or substitutes for the German materials no longer available. Such hastily organized research was always costly and usually inefficient. Meanwhile the German laboratories were quickly and effectively engaged in producing substitutes for the materials denied to Germany by the British blockade, substitutes without which the war could not have lasted as it did, and in developing new and terrible weapons of offence, from which the Canadian troops were first to suffer.

So, among the lessons which Germany taught the world, was the value of the industrial laboratory. In England and in the United States alike the firm resolve was made never again to permit a possibly hostile state to obtain such a monopolistic eminence in the industrial applications of science. Even during the war, plans were formulated for ambitious and permanent research programs, and no time was lost after the armistice in putting those programs into effect.

Every large industrial corporation organized its own research laboratory. National Research Councils were formed to promote co-operative research by those industries in which the companies engaged could not afford individual laboratories, and to try to co-ordinate for better efficiency the work of the existing laboratories. Universities hastened to establish research departments to train the men demanded by this new scientific growth. Even the American Federation of Labor, realizing that the high wages and shorter hours won during the war could be retained in peace only through increased efficiency in production, passed resolutions and memorialized Congress urging national support of industrial research. Papers, magazines, and books, have been filled with dissertations on the value of research, and countless addresses have been made in furtherance of its extension, until now there is danger that the word research may become as obnoxious through repetition as the word co-operation became during the war. And it is a real danger. You remember the Athenian who was banished because his fellow-citizens wearied of hearing him called "the just." So I fear that continued harping on research may at first bore and then irritate the public mind. And the public memory is all too short. The war lessons, quickly learn

ed. are many of them being all too quickly forgotten, and among them may go the appreciation of the value of research.

And there are many specific causes for discouragement. I know of large industrial laboratories started since the war which have been discontinued. I know of sections of the National Research Council where the only accomplishment has been to hold a committee meeting and print the minutes. Much of the research work undertaken at universities has been characterized by the Carnegie Foundation as "pseudo-research." I have seen one annual report of the research section of one large engineering college which described some twenty problems on which the students were engaged, and not one of those problems was what I would consider true research, nor of value in teaching research methods.

These things may result in discrediting research and in starting a backward swing to pre-war conditions. Should that swing occur, it would be a long and difficult task, without the war stimulus, to get back again to where we now are.

The extent of that loss could be testified to by anyone in the General Electric Co. who knows what research has done for that Company. Whole factories and larger sections of other factories are engaged exclusively in producing devices or materials that originated in the Research Laboratory. Every department of the company has profited in the way of improved device or reduced cost by the work of the laboratory.

The General Electric is not unique among companies with industrial laboratories. Its experience is typical. Why then the disappointments and discouragements to which I have referred?

I believe they have arisen from mistaken ideas about research. The Standard Dictionary defines research as, — "A systematic investigation of some phenomenon or series of phenomena by the experimental method to discover facts, or to co-ordinate them as laws." "By the experimental method, to discover facts." That is the essence of the definition. The one qualification I would make would be to limit the facts sought by research to generic facts. What I mean is this — It may be desirable to know the open-circuit voltage of a certain battery to another decimal point, but to obtain that fact by refinements of measurement is not research. It tells us more about a finished thing. It does not give the kind of new knowledge, or new principle, which makes possible the development of new devices. The failure to recognize this distinction is the reason for what I have referred to as "pseudo-research" at some universities. Teaching students to measure is instructing them in laboratory methods, but it is not teaching them research.

For not all laboratories are research laboratories. This is as true in industry as in academies of learing. An industry may

have need of extensive standardization, the development and standardization of instruments and test methods. For that work it may require an extensive laboratory with a staff of highly trained engineers and physicists, but that work is not research.

Again, an industry may require scientific control of factory materials and processes. It may need technical purchasing specifications and acceptance tests of raw materials; it may need metallurgists to control its foundry and its forge shop, and chemists to control the production of paints, varnishes, insulations, and ceramic products; but such testing and factory control is not research.

Still again an industry may need a development laboratory to improve its apparatus, to develop new devices, and to find new applications for its products. Such work may keep a large laboratory busy and yet none of it be research.

All these things, standardization, testing, factory process control, and development, have to do with specific things; they are bound up with and can exist only in connection with industry; they represent applied science, or engineering. Research on the contrary has to do with genuine facts or principles, it need have no connection with industry. It is fundamentally the same whether conducted at a university or in an industrial laboratory. It is essentially pure science until engineering development steps in to apply it.

Last spring we had the keen pleasure and great honor of a visit from Sir Joseph Thomson, Master of Trinity College, Cambridge, who is generally recognized by physicists as the greatest living scientist. There was a story current in my college days only a quarter century ago of a professor who suddenly called on a slumbering student and asked him what electricity was. The student, half awake, stammered that he had known but had forgotten. "Good heavens," exclaimed the professor, "The only man who ever knew what electricity is has forgotten!" The point of the story, such as it was, was the mystery surrounding the nature of electricity? Next to life itself, it was the most mysterious thing in the universe. To-day I think it is safe to say we know more about electricity, know more truly what it is, than of anything else in the universe. This wonderful extension of knowledge is due to Sir Joseph Thomson, who discovered the electron, the unit of electricity; he measured it and weighed it and told us all its properties, and showed how matter itself was composed of electrons. Since then, physical and chemical research has aimed at explaining all other phenomena, even the phenomena of life, in terms of that simplest and most fundamental of things, the electron.

Now it is in vacuum tubes that the electron can most freely

display its properties, undisturbed by atoms and molecules. It was the discovery of the electron that made possible the research that led to the modern vacuum tube. So when Sir Joseph Thomson visited us last spring and saw in our vacuum tube factory the various types and sizes of tubes in quantity production, the newest and most powerful Coolidge x-ray tubes, and the high power tubes now used for radio transmission, and when he saw in our laboratory still more powerful tubes designed for power work, he was seeing the present state of a new and great development which had its origin in his own scientific discoveries.

This development did not spring directly from Thomson's discovery. Years of research on high vacuum, its production and measurement, and on electron emission from hot filaments, were necessary before the engineering development could start. But that research, though conducted in an industrial laboratory, differed not in kind from Thomson's, and in a sense was a continuation of it.

The story of this vacuum tube development is interesting as showing how one research after another by different workers laid the foundation for successive engineering developments, each more important than the preceding, and even now promising still greater things to come.

Edison, in the course of his engineering development of the incandescent lamp noticed occasionally an effect which has ever since been known by his name. He observed in certain lamps a blue glow which resulted in a rapid chewing away of the ends or one end of the filament. He also found that the effect never appeared in lamps that were specially well exhausted. He found that the blue glow was caused by the passage of current between the ends of the hot filament. He inserted a plate and passed current between the filament and plate. But when the vacuum was made too good the current stopped. That was as far as the state of knowledge of the action of an electric current permitted one then to go.

Then when radio telegraphy had been discovered, Fleming saw the possibility of using as a detector Edison's combination of hot filament and plate, and gave us the so-called Fleming valve. This was an engineering application of Edison's research. Next De Forrest discovered that the current in the Fleming valve could be controlled by the introduction of a third element called the grid. That discovery gave birth to a new and important engineering development, the De Forest audion. Still these tubes remained as low vacuum devices. They became inoperative if the exhaust was carried too far. They could be operated only at low current and low voltage, for around thirty volts the blue glow that Edison had first observed would set in, the action would be-

come erratic, and the tube would soon be destroyed. They were very useful for reception of radio telegraphy, but that was all.

But meanwhile J. J. Thomson had made his great discovery of the electron, and showed the part it played in the flow of current through gases. It then became evident that the Edison effect was the result of electrons emitted from a hot filament, and renewed interest was aroused. Still for a time the research workers could obtain no current when the vacuum was too good, and the conclusion was generally though reluctantly accepted that the electron emission was dependent on some reaction, not understood between the residual gas and the hot filament.

It is true that Richardson, working with a sensitive galvanometer, found he could get measurable electron currents, micro amperes, in a really high vacuum. He established an equation giving the relation between current, voltage, and filament temperature. But according to that equation the electron current obtainable from an ordinary lamp filament should be amperes, while other experimenters had obtained nothing large enough to measure.

This was the state of things when Langmuir of our laboratory began his investigation, to find out why the Richardson equation did not hold for higher currents. His research resulted in the discovery of the "space charge law." He found that electrons were emitted from the filament in accordance with Richardson's equation, but that in high vacuum these emitted electrons in the space immediately surrounding the filament, being as J. J. Thomson had shown particles of negative electricity, charged that space negatively and prevented additional electrons from leaving the filament. With the minute currents Richardson had used, the space charge was not effective, but with the attempt to draw larger currents in high vacuum it became the dominating thing. With poor vacuum the space charge was neutralized by the positive ions generated in the residual gas by collision with the electrons.

Thus Langmuir's work cleared up the apparent conflict between previous experiments and comprehensively explained all the phenomena. He went on to show that even in a high vacuum large currents could be obtained by quickly removing the electrons from the space around the filament, that is, by bringing the anode close to the filament and using a high voltage. Thus at once the hot filament vacuum tube was transformed from a low voltage, low power device, to a high voltage, high power device. Instead of milli-watts it could now handle watts and even kilowatts. For the first time we had a device capable of taking the output of a telephone microphone and amplifying it to any amount for radiation from an antenna. In other words radio telephony was born. Radio broadcasting became possible. A whole new industry was

created, giving employment to hundreds of engineers and thousands of workmen, with sales amounting to tens of millions of dollars annually.

Meanwhile Coolidge had taken Langmuir's discovery and applied it to the x-ray art. The Coolidge x-ray tube, with its high vacuum, and with its output always under exact control has revolutionized x-ray technique and has made possible new engineering developments greatly extending the field of usefulness of x-rays.

But these two developments, radio telephony and broadcasting and the revolutionizing of the x-ray art, important as they are, are probably not all the results to be expected from Langmuir's study of the Edison effect. We believe that vacuum tubes will find their place in the power field. With vacuum tubes alternating current may be changed to direct current, direct current to alternating current, alternating current to alternating current of another frequency, or direct current to direct current of another voltage. Already we have built a tube of 1,000 Kw. output at 25,000 volts. Such a tube is about the size of a golf bag. Certainly that does not represent the limit. We have operated x-ray tubes at 250,000 volts, 50 milliamperes. There seems no insuperable difficulty in building a power tube for such a voltage. That would multiply our output by 10, giving us 10,000 Kw. Much research and years of development will be needed before vacuum tubes can compete with rotary apparatus at ordinary voltages and frequencies, but it is entirely possible that in the super-power transmission of the future vacuum tubes will be used.

The story as I have just told it is only the main thread of the development, which drew on many other lines of research, previous and contemporary. For instance, when we speak of a vacuum power tube, we mean a real vacuum, a vacuum such as was unknown fifteen years ago. We had to learn how to produce and measure such a vacuum, to produce it not merely as a laboratory stunt, but in the factory in regular tube production. The advance that has been made in that direction is not generally appreciated. A vacuum is not a spectacular thing, but a few figures may indicate what has been accomplished. The vacuum in a well exhausted lamp is commonly considered a high vacuum. As a lamp comes the exhaust machine is has a pressure of about 10 microns or 1 100,000 of an atmosphere. That is, of the air originally in the bulb only one molecule out of 100,000 is left. But now to get such a vacuum as we have in a modern power tube we must take that exhausted lamp and pump it some more, until the residual gas we again have left only one molecule out of 100,000, — that is, we must bring the pressure down to a ten billionth of an atmosphere. It might seem that at such a vacuum there whould be no molecules left at all. Actually, at a ten billionth of

an atmosphere there are still remaining about 40 billion molecules to the cubic inch. It is hard to grasp such figures, but an illustration may help. Suppose we take a cubic inch of air at atmospheric pressure and enlarge the molecules to the size of sea sand, that is to particles that would just pass through a 100 mesh sieve. How big a beach could we make with that amount of sand? We could make one 3,000 miles long, 1 mile wide, and 3 feet deep.

Again, it is necessary not only to obtain these high vacua initially but also to maintain them through life. Here comes in the result of the long research by Coolidge which gave us tungsten and molybenum in wire, rod, and sheet, for these metals with their high melting point, much higher than platinum, can be heated to bright incandescence while the tube is on the pump, so as effectively to drive out the gas of which all metal is full.

Thus every real addition to our knowledge, whether it is a fundamental discovery, revolutionizing scientific thought, like Thomson's discovery of the electron, or the explanation of a baffling phenomenon by the establishing of a new principle, like Langmuir's "space charge law," or learning how to do something before impossible, like the production of high vacuum, or the mechanical working of tungsten, leads almost invariably to new devices, new arts, new manufactures, and new comforts or conveniences for mankind, and these ultimate results are seldom foreseen while the research is in progress.

It is for this reason among others that we always in our laboratory encourage much research that has little or no immediate application to practical problems, confident that if the work is well done the practical justification will follow. I could cite many illustrations of the justification of our faith, but Langmuir's work on the Edison effect is as good a case as any.

I do not mean that we scorn practical problems. The greater part of our work is directed to the solution of such problems. Some factory has run into trouble and asks to be pulled out. Some designing engineer needs a new alloy or new molded compound with certain properties and asks us to develop it for him. Such appeals always have first claim on our efforts, whether the answer comes in a few hours or in many months. Sometimes these bread and butter jobs bring results of scientific interest and wide application.

Again a large part of our work consists of attempts to improve our products. Most of that work originates in the laboratory. We have groups continually at work on incandescent lamps, radio tubes, x ray tubes, transformer steel, alloys, molded compounds, insulating varnish, lubrication problems, etc.

Again it is frequently necessary or desirable for the laboratory to develop and manufacture for a time some new material or

device before turning it over to a factory department. This was done with drawn tungsten wire, magnetite electrodes, x-ray tubes, radio tubes, several different insulating materials, etc.

We regard it as our primary duty to serve the company that supports us by helping other departments in all possible ways to improve their products and manufacturing methods, and to increase the scope of the company's business by developing new devices and materials. But always we devote as much effort as possible to pure science. Each kind of work helps the other. Science is always yielding new riches to be practically developed, and the contact with practical things helps the scientific worker to keep his perspective. The two advantages an industrial laboratory has over a college laboratory are, first,g reater facilities for getting things made, and second, the close contact with real problems. You remember the Greek myth of Antaeus who gained in strength from each contact with Mother Earth. Meredith in poetry and prose reiterates the same thought, that humanity must "touch earth" to keep healthy and sane. That contact is as salutary for science as for human nature. Because of these advantages the industrial laboratory should play an increasing part in the advancement of science.

But a large industrial laboratory must be a growth. It is said that Athena, goddess of science, sprang full grown and fully armed from the brain of Zeus, but we cannot do that sort of thing nowadays. The failures I spoke of earlier were the result of attempts to begin with a full grown laboratory. No man ever lived who could take a big new laboratory and make a success of it. The successful laboratory is built of men, and true research men, like true poets or true artists, are hard to find. Men with promise must diligently be sought, and as they are found one by one their special aptitudes must be developed and the right problems fitted to those aptitudes.

To an engineer that statement may sound overdrawn. I find few engineers recognize the wide difference between engineering and research, but the difference is very wide. It is very seldom that aptitude for both are found in one man. The mental attitude required is fundamentally different. The engineer is the type that likes to deal with certainties. He likes to utilize known materials, whose properties he knows and has confidence in, and to produce therefrom concrete results in the way of new structures, new devices. He likes to see the tangible result of his labors. The research man is primarily interested in the unkown. He seldom has the patience to carry a new idea through to a finished design. He differs from the engineer as the pioneer differs from those who come after him to develop what he has found. Kipling well

expresses that ceaseless urge toward the unknown, in his poem "The Explorer"—

"Till a voice, as bad as Conscience, rang interminable changes
On one everlasting Whisper day and night repeated, so:
'Something hidden. Go and find it. Go and look behind the range.
Something lost behind the ranges. Lost and waiting for you. Go.' "

It is this restlessness in the face of the unknown, that trait which Kipling elsewhere characterizes as "insatiable curiosity" which marks the research man, but to be successful he must also have the gift of observing and questioning even the commonplace. Just as to the poet "a primrose by the river's brim" was "something more," so the spreading of oil on a river's surface, which was to others merely a pretty irridescence or an obnoxious fouling of the water, was to Langmuir a method of measuring the exact dimensions of the oil molecule, and distinguishing one oil from another. The research man also needs the scientific imagination to construct hypotheses, the analytical ability to devise the crucial experiments to test the hypotheses, the resourcefulness, manipulative skill, and persistence to carry through the experiment, the perspective which distinguished the essential from the non-essential, and the reasoning which co-ordinates individual facts into a principle.

We need to seek such men, and in Capt. Cuttle's language, "When found, make a note of." We need such men in industrial laboratories, but we need them equally in colleges and universities, to inspire and to train students with aptitude for research. With the necessary effort, the men can be found and research widely developed. Germany has shown it can be done, and the British Empire and the United States should be able to outstrip Germany, for we have one thing that the German lacks, the inborn spirit of team play. In the German laboratories before the war, each laboratory room was under lock and key. No one but the general manager knew what was going on outside of his own room. We don't do things that way. We can co-operate without jealous friction, for the good of the team, and in that way the output rises nearly in geometric proportion to the number of workers, for each helps all the others.

So let us here, on both sides of the St. Lawrence, do what we can to stimulate research. Research will do for all our industries what it has already done for the General Electric Co. and others. More than anything else it will insure our prosperity. We are interested in Canada's prosperity and Canada in ours, for next to England we are each the other's best customer. And if ever another war comes, as we pray it will not, our large industrial laboratories will be among our greatest military assets. Some nine months after the U. S. entered the world war, a visitor from

the British Admiralty to our laboratory commented on the speed. to him remarkable. in getting our submarine detectors developed and into quantity production. and he attributed our advantage over England in this respect to the fact that our physicists. designing engineers. and factory men were all trained through years of peaceful development to work as a team with huge resources to back their efforts. The next war. if it comes. will more than ever before be a war of applied science. and Canada should therefore rejoice to see in the United States. and the United States should rejoice to see in Canada. industrial laboratories growing and multiplying. as most important factors in national defence. for. although this is not the time nor place for international politics. I am sure you all agree with me that if another great war must come. it is to be hoped and confidently expected that it will again find the British Empire and the United States. this time perhaps without so many prefatory notes, with all their resources. including all their laboratories, fighting side by side. (Applause.)

A. MUNRO GRIER:—It is sometimes said that romance is dead. The utterance which we have just listened to from Mr. Hawkins proves that the statement is entirely false. for it is quite evident that so long as electricity remains. romance is to live. In earlier days we thought it wonderful to read in the "Arabian Nights" how the rubbing of the lamp would immediately produce light. but that is as nothing compared with the wonder of the effects to be produced today by the mere touching of a button.

It has also been said that sentiment is dead. but I venture to say that that also is quite untrue. Already at this Convention I have adverted to the wonder of our union here at this Convention. in that we have not only men attending the Convention. but also the ladies. Besides that. however. what is there to be said as to other unions? Contemplate the wonder of this present situation Here we are gathered together in the City of Montreal. in which there dwell not only French-speaking. but also English-speaking people. I would have all Canadians remember that they are entitled to the heritage which comes from each of the two great countries—England and France. Let the English-speaking Canadian bear this well in mind. and let him always count it an honour and privilege and matter of credit to be living as a fellow countryman with his French-Canadian fellow countryman. On the other hand. let the French-Canadian take an equal pride in living side by side with his English-speaking compatriot. We must never forget that to us belongs the heritage of the great men — whether great orators or great engineers or great philosphers, of both of these two countries — England and France. (cheers)

But the wonder of the thing does not finish there, because we have gathered here not only the Canadian descendants of

France and England, but we also have representatives of the great country to the south of us. For my own part, I always feel it my duty, whenever I am speaking in public, to sound this note of the desirability of a closer union between the British Empire and the U. S. In my judgment it is not less than criminal to say anything which is likely to jeopardize those relations, and on the other hand it seems to me that a man is performing one of the highest duties who does all that he possibly can to bind together more closely these great countries. (prolonged cheers)

If I am to give you my own individual view, it is this. That if at any time the British Empire and the United States were absolutely at one, it would lie with them to say to the rest of the world would it should not do, because united they could not be withstood by any other possible combination of nations.

(at this point the audience rose en masse and applauded.)

I recognize instantly from your attitude in rising at the last utterance of mine that you are entirely in agreement with me and that sentiment is not dead. The subject is so enthralling that if I am really to confine myself to a few minutes, the only thing to be done is simply to stop, without daring to venture further.

Let me summn up in just a few words, in these simple phrases. There never can be a disunion between, on the one side, the land of the British Empire, and on the other the land of the United States, lands over which wave the two flags, Old Glory and the Union Jack . (cheers and clapping).

FRIDAY AFTERNOON SESSION:

PRESIDENT: The first item on the programme this afternoon is the report of the Power Sales Bureau, Mr. Gall, Chairman.

(See Report in Advance Proceedings

D. M. GALL: I am taking it for granted that you have all read the report of the Power Sales Bureau, as printed in the Advance Proceedings. I will just run over very briefly the various subjects dealt with. The first subject you will note, is that of Industrial Electrical Heating. Our Committee feels there is a great field for this industry, and strongly urges most active cooperation between manufacturers and central stations on the building up of this important load. You will note a letter reprinted in the record, sent in by representative of one of our large manufacturers. The industrial heating load bids fair to be one of no mean importance.

The second subject dealt with in the record is that of Power Factor Improvement on AC Mains. The question of power factor correction is of great interest to power companies. We would like to hear opinions of the members present on this matter.

The last subject dealt with, and probably the most important, is the question of the standardization of the Power Contract Form. This standard power contract as presented in proceedings was drawn up by your Committee, after discussing and examining many power contract forms in use. We also had working in conjunction with us representatives of the Meter Committee. You will note that there are certain clauses that are standard and should be included in all contracts. In addition, there are other clauses, substance of which should be included in all contracts, but the exact form of which is open for discussion. We feel sure that the various items dealt with are of interest to all members, and we invite discussion on the paper as presented.

The standard power contract is quite a lengthy affair but we feel that we have been able to present something in concrete form that probably is not perfect, but on which we would like to have some discussion as it would be a splendid thing if we could have a standard contract drawn up somewhat along these lines.

I do not think there are any remarks I have to make as I think probably the report speaks for itself.

Thank you. (Applause.)

PRESIDENT:—I really feel in some ways we have not treated Mr. Gall properly, in cutting him off so quickly, because I know the amount of work he put in upon this report, which is so very explicit. I sat in on the Committee and I know we had quite a stiff time drawing up this contract form. I might say I had hoped to have had printed a series of contract forms exactly in accordance with this report. I made up my mind, and agreed with Mr. Gall that our Company would adopt this form absolutely, without any changes at all, and I had hoped to have been able to give you each a copy of a contract form which embodies completely these several questions. Later, if anyone wants a copy, I will be glad to let them have one. We are going to print a standard contract, and have all our contracts in accordance with what the Committee has thought the best form.

If there is any discussion we will be glad to hear it.

F. A. CHISHOLM:—This Committee's report makes use of the phrase "Total Installed Capacity" in horsepower of the motors. Lawsuit with which I have recently been connected revolved around the phrase "Connected capacity of the apparatus installed." The decision of the experts was that the best terminology to use is "The rated capacity of the current consuming devices so connected as to be capable of taking power from the Company's system." I think the Committee should take note of this. Personally, I think that all loads should be measured by a maximum meter irrespective of the size of the installation. Measurement of the load leaves nothing to dispute.

PRESIDENT: Thank you, Mr. Chisholm.

D. M. GALL: You may notice it was only intended with very small installations, probably something less than 50 KW.

F. A. CHISHOLM: We have contracts under 50 KW at high voltage, in which consumer installs all apparatus. This clause would not cover that in case of dispute.

PRESIDENT: Any other discussion, gentlemen? If not, I move that this report be adopted. All those in favour?

(Applause.)

Now, I have much pleasure in calling upon Mr. S. G. Hibben, of the Westinghouse Company, to address us.

THE EFFICIENT DAYTIME LIGHTING OF INDUSTRIAL PLANTS*

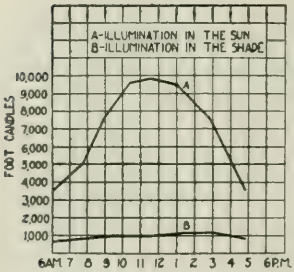
MR. S. G. HIBBEN:—Industrial plants operate principally in the daytime. The items, therefore, of most interest to the superintendent or general manager are naturally those having the greatest influence on the efficient daytime operation of their plants. Our studies of illumination on the other hand are usually confined to artificial lighting at night. As a result we are inclined to disregard those plants which only operate during the day and thus neglect opportunities for business.

The statement that no night work is done should not discourage the lighting engineer for his services are still required. The purpose of this paper is to demonstrate this need for the engineer and to discuss daytime lighting, both natural and artificial, paying special attention to the necessity for and efficient use of the latter.

Windows and skylights in industrial plants are desirable for their psychological effect on the workers; to provide an economical method of ventilation; and to admit daylight. The appreciation of this is shown by the modern tendency in factory construction buildings. In fact, the latest concrete buildings leave only enough of the walls for actually supporting the structure. The underlying thought seems to be that natural lighting is free and should be employed as fully as possible. Unfortunately, however, daylight for factory ilumination is far from free.

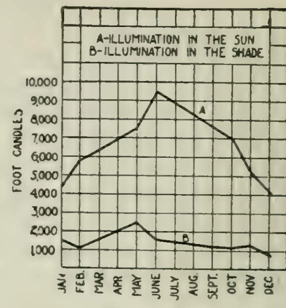
In estimating the initial cost of natural lighting we should include the increased building cost of having walls with windows compared to those without and, in addition, the cost of the necessary extra heating equipment. Operating costs should also be included covering interest on the above investments, depreciation.

* Summary of an address presented before the Canadian Electrical Association, Montreal, June 1923, by Samuel G. Hibben, Illuminating Engineer, Westinghouse Lamp Company.



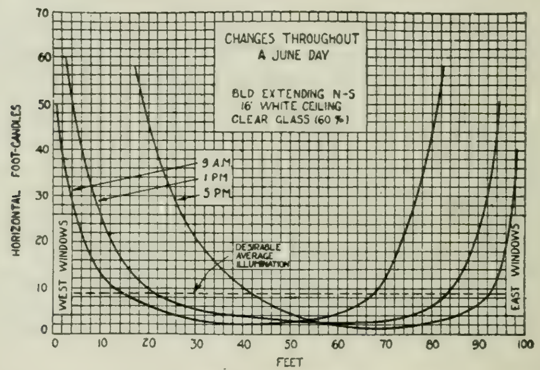
OUTDOOR ILLUMINATION
DIFFERENT HOURS OF A JUNE DAY

Fig. No. 1—Outdor Illumination Throughout a Bright Day



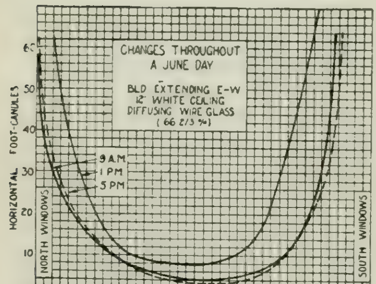
OUTDOOR ILLUMINATION
DIFFERENT MONTHS OF THE YEAR

Fig. No. 2—Variations of Illumination from Month to Month



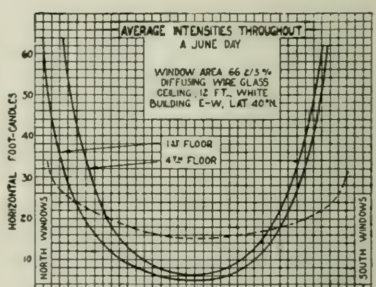
INTERIOR DAYLIGHT ILLUMINATION

Fig. No. 4—Interior Daylight Illumination in N-S Building



INTERIOR DAYLIGHT ILLUMINATION

Fig. No. 3—Interior Daylight Illumination in E-W Building



INTERIOR DAYLIGHT ILLUMINATION

Fig. No. 4—Daylight on First and Fourth Floors

glass replacements, washing and heating. Based on these items, estimates have been made proving that it would actually be cheaper to omit windows and to depend exclusively on artificial light. Our problem, however, is not to re-design factories or to eliminate the use of windows but, realizing its cost, to make a maximum use of the daylight at our disposal.

To intelligently use natural light it is necessary to understand something of its characteristics. It is especially interesting to consider the intensity of daylight compared to the values of artificial lighting to which we are accustomed.

Figure 1 illustrates graphically the outdoor illumination throughout a June day, and similarly Figure 2 shows typical variations of foot-candles from month to month. Compared to this it should be noted that 2 foot candles is considered adequate for machine work while the industrial lighting codes only require an illumination of 3 foot candles for fine lathe work.

The fact that natural lighting is of so much higher value than the artificial lighting will be surprising to many, and it is of little wonder that the human eye, accustomed to shaded daylight of several hundred foot-candles, frequently finds it difficult to function well with artificial (or natural) illumination of less than five foot-candles.

These daylight values are easier to conceive if one considers the difference in taking a photograph undr artificial illumination, and by daylight. An exposure of a fraction of a second (for example 1/25) in the latter case will usually be ample, while at night at least a minute (1,500 times the former exposure) will frequently be necessary. It is a fact that the standards of artificial lighting have been fixed within a range that has had for its limitation the cost for electric power, and have not been based upon the values at which the eye operates best. As the lighting art develops, and as greater light output becomes possible with the same operating costs, it is reasonable to increase the foot candle standards to ranges that enable the eye to function more rapidly and accurately, i. e., if not to simulate shaded daylight illumination, to at least secure " productive intensities."

sureall expect that sufficient quantities of daylight would exist
urcally expect that sufficient quantities of daylight would exist in most any interior having reasonable window area. This, unfortunately, for the industrial plants is not the case and natural lighting is frequenty inadequate even in the summer months. With relatively low ceilings compared to the width of the building the intensities drop off rapidly as the distance from the windows increases. Figures 3, 4 and 5 show characteristic daylight distribution in modern factory interiors with white upper walls and ceilings.

Figure 3 illustrates the values of interior illumination throughout a June day for a typical factory building in the latitude of New York City. Similar data is given in Figure 4 but in this case in a building extending in the direction of north-south while that of Figure 3 extended east-west. In the first case it will be seen that the only change throughout the day was a proportionate increase in the values in the middle of the day. In the second, however, where the sun crossed over the building the distribution is completely changed. The third chart (Figure 5) illustrates the higher daylight values prevailing on the upper floors of a building compared to those on the ground floor.

It should be noted that these measurements were taken in modern factories with light colored interiors and having large

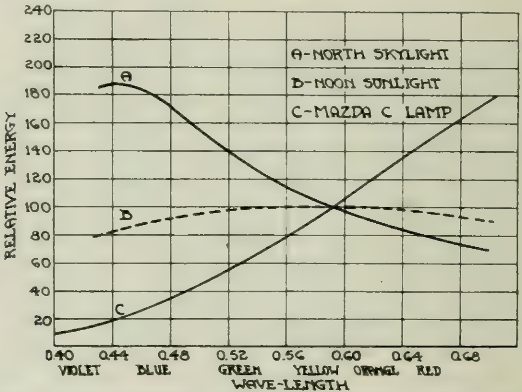


Fig. 6 — Relative color compositions of natural and artificial light.

window areas. The glass, as indicated on the figures, was clear in one case and diffusing wire glass in the others. Good maintenance with clean windows prevailed and little loss can be attributed to dirt. If such lighting conditions exist in buildings of this character it looks as if there was considerable work for the lighting engineer even if plants confine their operation to daytime.

Another interesting phase of daylight is its color. Figure 6 ilustrates graphically the relative colors present in north skylight, noon sunlight and the Mazda C (gas-filled) incandescent lamp. Curve B, noon sunlight, is approximately horizontal and shows that the various colors are all about equally present. North skylight (A), however, has a predominance of blue while the incandescent lamp (C) is just the opposite being weaker in the blue and having an excess of red. This latter curve is typical of a 200 watt Mazda C lamp. Higher wattage lamps have curves which approach slightly nearer that of sunlight. Considering these var-

iations in colors it will be understood that marked changes in appearance will exist in the same materials when viewed under different lights.

In planning the daytime illumination for buildings our first thought should be to make the maximum use of natural light, bearing in mind its cost in windows and in extra heating expenses. As may be seen from the interior daylight curves the illumination in sections away from the windows may be inadequate even on a June day. Slight, if any, improvement could be made in the buildings in which this data was obtained. White upper walls and ceilings with diffusing glass here insure a maximum natural illumination. In many industrial plants, however, considerable foot candle increases can be effected.

Ribbed or prism glass windows will direct an appreciable amount of light across the room if installed with the prisms horizontal. Some superintendents prefer diffusing glass for this purpose as it accomplishes approximately the same result and is not affected as much by the unavoidable accumulations of dust and dirt. Soap and water will also work wonders in improving daylight conditions.

When diffusing cribbed glass is used to direct the daylight to the interior of the room the windows are liable to become excessively bright especially when receiving direct sunlight. Light colored translucent shades or curtains should be provided to accommodate changing exterior conditions. An excellent method of eliminating glare from sky brightness or sunlight is to install double shades or curtains affording a very flexible system which permits the shielding of bright sections without covering the entire windows. The use of these devices should not be left to the whims of individual workers but placed under the jurisdiction of the room foreman.

Another important feature is the color and cleanliness of interior surfaces. The walls and ceilings are really secondary light sources reflecting the light that strikes them. As the rays are reflected and re-reflected several times a slight increase in the reflection factor will have a marked effect on the illumination. For example, an increase of 10 per cent in the reflection may result in an increased foot-candle reading of, say, 20 per cent. It is therefore, advisable to maintain these surfaces in as light shades as practical. Both the natural and artificial lighting will be improved and the hours of artificial lighting frequently reduced. Besides enhancing the appearance, painting should pay for itself in reduced current consumption.

After taking all possible steps to secure the best daylight illumination we find that artificial lighting is still necessary. Estimates show that 17.5 percent of industrial work is now done on

Fig. 7 — Good natural lighting — Light colored walls and ceilings; large windows of diffusing glass, equipped with double curtains to shield excessively bright areas.

Fig. 8—Bad practice—Ample illumination on the work but dark surrounding provide extreme contrasts, conceal possible accident hazards, and discourage neatness and order.

tirely by artificial light. Actually, however, the majority of our factories use some artificial illumination all day. The work of the lighting engineer is to explain to industrial managers the necessity for this and to assist them in planning installations to efficiently supplement daylight.

A most important step is to design economical control. Circuits should be laid out parallel to the windows, eliminating the necessity of lighting lamps near the windows when only light in the middle of the room is required. The control panels should be placed in convenient locations and put under the charge of a responsible employee. Considerable economies can be effected in this manner. It is difficult to find an industrial plant where unnecessary lights are not burning while inadequate illumination prevails in adjacent locations. Instances can be cited where high wattage lamps have been found burning under skylights receiving direct sunlight.

Referring to figures 3, 4 and 5, it will be seen that the center areas are unworkable for even rough operations. The daylight is not only inadequate here for efficient work but is not sufficient to meet the requirements of the industrial lighting codes which merely require foot-candle intensities for bodily safety. The foot-candle meter is necessary in daytime as well as at night to demonstrate the need for supplementing natural light.

Frequently locations will be found where daylight is adequate for the general illumination around the machines and benches but is not sufficient for fine or exacting work. Sewing on dark goods, boring out of castings, and fine machinery are examples of this. Here high intensity general lighting would be most satisfactory from an illumination viewpoint but rather expensive. The answer is to provide a well designed local lighting system to be supplemented by natural light during the day and artificial light at night.

Where local lighting is necessary just as much care and thought should be given to such installations as to the general illumination. Present practice leaves this to whims of the individual with a resulting conglomeration which has condemned local lighting. It is just as important to have efficiency here as in the overhead installation. Tests of local lighting reflectors show that they frequently have an efficiency of less than 35 percent. If we obtain 65 to 75 percent in the overhead units there is no reason why this can not be duplicated. In addition to this difference in initial efficiency still lower output is found in practice owing to the poor quality of the reflecting surfaces. A good local lighting reflector should be at least 65 percent efficient, adequately shield the light source from the worker's eyes and have a reflecting sur

face which soap and water will readily restore to its initial efficiency.

Referring again to Figure 6, it will be appreciated that the question of color is another feature to be considered in planning the artificial system. Daylight Mazda lamps with the blue bulb absorbing some of the red and yellow rays emanating from the filament will provide a means of approximating daylight. Enclosing cased-glass globes with one layer of blue glass accomplish the same result. Where accurate identification of color is necessary there are available specially designed units employing standard clear bulb Mazda C lamps, the light from which is filtered through an exact blue-green glass screen.

Fig. 9—Efficient Artificial Lighting — High intensity illumination (50 foot-candles) over table tops with general illumination (8 foot-candles) providing well lighted surroundings.

Figures 7, 8 and 9 show views of an industrial interior in which fine bench work is done and illustrate a method of providing efficient illumination throughout the entire day. The large windows of diffusing glass together with the light color interiors insure the maximum utilization of daylight, while double curtains permit the shielding of excessively bright window areas. During the day when natural lighting is adequate for general illumination, but does not penetrate to the interior sufficiently for fine work, 50 watt Mazda B lamps in standard bowl reflectors provide 50 foot-candles over the bench tops. As daylight fails the

overhead units consisting of 50 watt bowl enameled Mazda C lamps in R. L. M. reflectors give a general illumination of 8 foot candles. These are controlled parallel to the windows and are turned on as required. Economy, efficiency and good lighting both day and night are insured. (Applause.)

PRESIDENT: Gentlemen, I am sure we have listened with the greatest of interest to Mr. Hibben. We have heard him before, but I must say today he has not repeated himself at all. It is a great favour for us to have him with us at our Convention, but as the hour is growing late and we have a lot to do yet, I will ask him to permit us to dispense with our formal vote of thanks at this time. (Applause.)

Next item on our programme is the report of the Merchandise Sales Bureau, Mr. G. R. Atchison, Chairman. I will ask him to present this report.

G. R. ATCHISON: Mr. President and gentlemen, I will try and be brief and read over some particulars with regard to the report.

(See Report in Advance Proceedings)

PRESIDENT: Gentlemen, this is a very important subject indeed, and I don't want us to gloss over this either. I would like to give ten or fifteen minutes to this, and would be glad to do it, and call for discussion immediately.

A. A. DION: Mr. Chairman, there is one point in the report in which I do not agree. The report says, if you should sell an appliance and guarantee it for a year, you should simply replace the defective part and charge for labour replacing it. To my mind it is absolutely wrong. Why should the customer pay anything if you give him something not good? I don't think if that practice was followed, it would lead to many more sales among the friends of the utilities affected.

PRESIDENT: It might lead to the manufacturers turning out a better article.

A. A. DION: In the meantime, don't charge for labour.

PRESIDENT: I would like to hear more expressions of opinion on that point.

Would any of the Shawinigan men with us today care to discuss the question of renewals? I am sure there must be somebody. Mr. Gilchrist knows. Could we hear a word from you?

J. W. GILCHRIST: I am very glad of the opportunity to discuss the excellent report of Mr. Atchison's committee. I feel that in the development of the sale of electrical appliances we have one of the biggest possibilities for our companies which we have given our attention to. I know that the study I have made during the last two or three years has opened my eyes to its possibilities. I just would like to know, as a matter of interest, how

many of the companies represented by the men in this room are selling in gross dollars and cents 10 per cent in appliances of the amount that they are selling in electricity? Will they please hold up their hands?

(Response from one—Mr. G. R. Atchison, Southern Canada Power Company)

One. Now that is a very considerable amount. Any company doing a business of five million a year, and doing half a million dollars of appliance business, cannot afford to ignore that volume of business. If they could make it one million, or a million and a half, or even two million, it would seem a very big amount, and it would seem beyond the possibilities of the business at the present time. But I don't believe it is at all beyond the possibilities.

Mr. George Baldwin of the General Electric Company, who has charge of the manufacture of this kind of apparatus and appliances for his company, and the distribution of them, has made a very careful investigation of the number of devices which can be used in even the humble homes today with great advantage, from the standpoint of economy and the standpoint of saving and conserving strength, health and time, and he has reached the conclusion that between six and seven hundred dollars is a very conservative estimate as to their value. Now, just conceive of a business selling one-quarter of that amount. Supposing you could only sell \$150.00 or \$175.00 of electrical appliances to every home—and I know from experience in my own home something of the value of these devices. Take just the commonest of them—the washer, the ironer, the vacuum cleaner, and the dish washer, if you please, without touching the range, which in some communities is the biggest one of all, not only from the standpoint of merchandise sales, but also from the standpoint of its effect on your electric income—and you immediately begin to visualize the business which is waiting for the company which will go out after this business in the way it deserves to be gone after. In the City of Chicago we have paid a great deal of attention to the development of the small customer. We began several years ago, and as a result we have upwards of half a million residence customers on our lines. That would mean, you see, if we only sold them one hundred dollars worth of merchandise each year, six or seven years of hard work to reach the figure I just mentioned.

Now, there are a great many obstacles in the way of this, Perhaps the greatest one is that notwithstanding the very great value of these devices, they have to be sold. You cannot get people to come in and buy them. You have got to sell them, and that costs money. We find that in the business which we are doing in Chicago, approximately four million dollars of appliance

sales (which I feel almost ashamed to name, in such a wonderful community, from the standpoint of its purchasing power), we are sustaining a very substantial loss. Now when you are doing business in a small way you can afford to absorb that loss, but when you begin to do it in a big way, it is repulsive to think of devoting your time to a business which is done at a loss, regardless of how it may affect your revenues from the sale of electricity. Furthermore, we are satisfied that it is not at all necessary.

We have had experience in the business of selling washing machines, for instance at $125.00, and taking identically the same machine and putting the list price up to $175.00, with 5 per cent discount for cash, and adding to the list price about $20.00 for selling it over two years' time, and the result has been that our washing machine business is growing bigger every day. We are selling in dollars and cents three times the volume at $195.00 as we ever sold at $125.00. There are very few who will disagree with the theory that it is desirable for the central station to enter into this kind of business. I believe that the central station should be the leader, but I also believe it should sell its goods on a basis which will enable the smallest dealer to compete profitably so that he can meet the prices of the central station and make a profit. I think Mr. Edgar, president of the Edison Electric Illuminating Company of Boston, has made a very excellent suggestion in that connection, namely, that the central station with its greater buying power, would obviously make a great deal more money than a dealer, and consequently if the dealer were making more money than it should. His suggestion was that the central station should devote its excess earnings as a result of that situation to general advertising of the sale of the devices in the community, for the benefit of all concerned.

This is a problem which must be worked out with the manufacturers, and with the jobbers and dealers, as well as the central station, because they all have their very important functions, and we cannot leave out any single one of them.

Now the greatest obstacle which we run across is the list prices which are placed on the articles by the manufacturers, and as it has been pointed out many times, the central stations are more responsible than anyone else for this condition, because they adopted policies, when this apparatus first came on the market, which encouraged manufacturers to mark goods as they are now marking them. I say, give us a higher list price. If you are not making the proper amount of money at present, raise the selling price, but either eliminate entirely the list prices, or put them up to a point where there will be a proper margin in it for the people who are essential for the broad distribution of this kind of appliances. I think a good many of them are beginning to see the

possibilities. Of course, I am thoroughly alive to the necessity of running an economical business. The manufacturers say to us, "You gentlemen are not real merchandisers, you do not do business in a business way. Your expenses are too high. Your turnover is not what it should be." I grant that, and I believe that the matter of turnover is especially serious, because that, as everyone knows who has ever done any merchandising, is one of the greatest factors in selling at a low price, and in spite of that making a profit. But the first thing we have got to do is to get on to a basis where we can make some money, and then pay attention to the matters of turnover and cutting down expense. I believe that the work which is now being done is going to have a very great effect, and when we are all making money, as we should be, in the sale of these devices, there will then be an incentive which will appeal to our shareholders and everyone connected with the business which will permit us to push it to the limit.

There is one thing I want to speak of—the question of selling these appliances on deferred payments. I think a great many of us at the beginning had the feeling that deferred payment sales were undesirable. Some people took the position that in encouraging people to buy on a deferred payment basis we might be encouraging extravagance—that we were encouraging people to habits just the opposite of habits of thrift. I don't agree with that. I do not think the differentition as between thrift and extravagance is drawn at the right place. There isn't anyone of us in the central station business—there isn't an intelligent manufacturer anywhere in the country—who will back away from the spending of money, the spending of money which is necessary to acquire necessary and efficient machinery. Where would this industry be, how would it have gotten on its feet, if we had been of such a turn of mind that we would not borrow money? How would we get all the money necessary for expansion if we had only the excess earnings of the business to draw on, over and above a fair return on what we put in it? This business—the utility business—and the railroads and great corporations which have low turnovers, are notorious for the very large amounts of money which they borrow, and what is that but buying goods on deferred payments? Where the line should really be drawn is not as between cash and deferred payments, but as between whether you are encouraging people to buy things on deferred payments which will tend towards thrift, economy and conservation, as against pure extravagance. I don't think that any of us will claim that so far as a great many of the labour-saving devices, which we call appliances, are concerned, that it is an evidence of extravagance or wastefulness to sell them on a deferred payment basis and put them into operation in the homes of the people. It is really a

saving and that spirit should be encouraged. We started out by selling this stuff on three or four months' time. I remember when we first started on fans. We sold fans the 1st of May on three payments, the 1st of June on two payments, and on July 1st we insisted on cash, because we felt that if a man ran into the winter and had a fan left on his hands, he would never pay for it. For a good while we did not include fans in our deferred payment list.

I have made some careful investigations as to the losses which come from the extension of deferred payments, and I find they are absolutely negligible. We have sold in our merchandise business in Chicago, perhaps some 50,000 washing machines, and we never have had but one of our washing machines actually stolen. We do have cases of having to take them back through people stopping payment, through losing their jobs, or some such reason, and not being able to keep up payments. That may run 5, 6, or 7 per cent, and some years, in bad times, as high as 8 or 10 per cent, but we never lose the goods. Sometimes you may lose small articles like an iron, for those things dishonest people will sometimes get away with. Therefore, if the losses from deferred payments come as a result of people being unable to pay, it follows, and has been demonstrated, that the smaller the payments, the less you lose. That seems an utopian idea, but I will suggest to any of you that you try the experiment, and if you will take a device which sells for $100, and sell one thousand of them on 10 months to pay, and another thousand on 20 months to pay, in the first case at $10.00 a month, and in the second case at $5.00 a month, you will find your percentage of losses with the $5.00 group is very much smaller than with the $10.00 group, because it is easier to pay $5.00 than $10.00 a month.

Without any question, the customer pays the interest very willingly. You say, "Possibly we do not want to tie up the money." I understand that here in Canada particularly, there are a great many companies that do not want money. They are not going into the customer ownership movement because they have not had occasion to want money for several years. Why not invest the money in the sale of these appliances, which will build up your load and give you an income, just the same as you would invest the money in extensions, or meters, or transformers? You are selling your meters, your transformers, and your lines on deferred payments—nothing else. You are selling on deferred payments of from three to ten years, and you do not think anything of it, and yet you would not be in nearly so good a position if that business dried up—you would not get anything like the amount out of that equipment as you would out of the same amount of appliances which you might have put into use and which you

might have to withdraw. The reason you have not done it is because you have not studied the situation to a point where you have as conclusive evidence of the soundness of the plan of putting these appliances out on long deferred payments, as you have on the plan of extending your lines into new sections. You say, "Our experience has led us to the conclusion that we never lose on such construction—whenever have to pull down a line, or pull down a transformer or meter." If you will go into this thing I am satisfied you will find you will have exactly the same experience in the sale of appliances on deferred payments.

I believe the tendency in the sale of these appliances, especially the big ones, will be not only to sell them on eighteen and twenty-four months, but to run them up to thirty months, and even as long as four years. I believe our losses will be lower—very much lower—than they are now when sold on a basis of six months or ten months to pay.

Now just one more word and I am through. Going back again to the question of the volume, a few years ago some man who was enthusiastic on this business said, "You will get as much from the sale of appliances as you are getting from the sale of electricity to residences." It seemed to me it was impossible. I undertook to analyze the situation. We got $27.00 a year of income per residence customer, and, by the way, it is about $4.00 higher than it was before we began to push the appliances with the same energy as we are pushing them now, and I very soon convinced myself that it was a very easy matter to sell $25.00 worth, or should be an easy matter to sell $50.00 worth. Perhaps that is a little high as an average, but I do not know that it is, if put on a proper basis. Now the effect it will have on your revenue will be great. There are many instances where the prices for the sale of electricity are very much circumscribed. Here is an outlet, not only for the sale of a large volume of appliances, and for the making of a substantial sum of money, but for developing public relations and making the people feel they are dependent on you, in a way which you will find it very hard to equal in any other branch of the business. (Applause).

T. F. KELLY:—There are one or two things I would like to have an opportunity of discussing as a manufacturer member of this Committee. I think that the manufacturers certainly owe a vote of thanks to Mr. Gilchrist for so ably taking up our cause with you gentlemen, in selling you the idea of pushing the sale of electrical appliances. I believe that every manufacturer realizes that his interests are with the retailer, and that the retailer should receive proper discounts. I have never been able to understand since the publication of the Merchandise Sales Report of the National Electric Light Association for this year, why this Bureau

saw fit to publicly bring out the fact that 2 Class A members of the Association thought that the markup was too great, and, for the purpose of selling appliances, reduced the markup. That is, they reduced the selling price so that they might sell the appliances. It seems to me that the Merchandise Sales Bureau of the National Electric Light Association have made a big mistake in featuring so publicly that those 2 central stations received too big a discount, and, for purposes of their campaign, have been selling merchandise at less than the price suggested by the manufacturer. Analysing these 2 campaigns, I cannot believe for one minute that the reduction in the price made them worth while, because anyone who is familiar with the sale of appliances appreciates that these 2 particular campaigns have been surpassed where prices have been absolutely maintained. I think the class A members of this Association are very much alive to the fact that prices should be maintained. The manufacturer, I believe, wants that done. He wants the retailer to fall in line, and I have, since the publication of this report, never been able to understand why, in the face of all the things Mr. Gilchrist has said during the past year about the proper markup that is necessary, the Merchandise Sales Bureau should tell us about the 2 instances of central stations reducing the selling prices. I would like to know how they took care of the contractor-dealer during that period.

PRESIDENT: I don't know whether Mr. Gilchrist cares to answer or not.

J. W. GILCHRIST: It takes all kinds of people to make a world.

PRESIDENT: I do want to thank Mr. Gilchrist heartily on behalf of our Association for speaking to us at such length a second time. It is kind indeed, and I am sure we have learned a lot. Mr. Atchison must have felt good when he heard Mr. Gilchrist talk about extending payments to four years. I thank Mr. Gilchrist for the many things he has brought to us today.

(Applause.)

F. D. BAKER: I want to say one thing on the year's guarantee. I represent a manufacturer and also have been in the business of a large retailer. I think that is one of the greatest mistakes in the world. Most salesmen start out and say they will give a year's guarantee. Why should an electric dealer guarantee a thing at all? You buy a suit of clothes and buy 99 per cent of your goods, and nothing is said about a guarantee. But when it comes to electric irons or washers, the first thing talked about is the year's guarantee.

C. D. HENDERSON: "I am glad Mr. Baker brought up this matter of guarantees, even though he has stolen my thunder.

I think the manufacturers of Electrical Appliances got off to a wrong start years ago. There is no apparent reason why a washing machine or an electric range should be guaranteed for a year. I had an experience a few weeks ago which brought this matter very forcibly to my attention: About two months ago I bought a new car and within two weeks the rear stop light went wrong. The garageman put on a new switch and charged me for it. I said "Why I thought this car was guaranteed for 90 days" His answer was that the guarantee didn't cover electrical equipment or tires and a few other things.

This guarantee question is a serious one and I hope Mr. Atchison and his committee will give some thought to 30, 60 or 90 day guarantee.

Just another point while I am on my feet. The matter of Discounts on Appliances: it is very questionable whether raising the retail price is going to accomplish the desired results. I may be overly optimistic but I believe within a few years, Electrical Appliances, will be sold off the floor without the necessity of having to canvass from house to house.

Take kitchen cabinets; refrigerators, etc. These articles have become stabilized and need no such expensive methods to sell . I think Mr. Atchison's plan of a broad national advertising campaign will bring this desired condition into effect in the electrical business sooner than some of us expect

Our Company had an experience a few months ago which was a great surprise to us. We put a Washing machine campaign in a certain large city selling 400 washing machines in 90 days and 62 per cent of these were sold off the floor without the help of outside salesmen.

I thank you!"

PRESIDENT:—Mr. Atchison, are you prepared to answer Mr. Henderson's question regarding guarantees?

G. R. ATCHISON:—I would rather not. At the time we had that in mind, but wouldn't like to say anything about it.

A MEMBER:—I think it is a matter that manufacturers and dealers should carefully consider — the report of the Chairman. Just where the six years' guarantee originated, I do not suppose anybody knows, and it may have been necessary at that time, when electrical appliances were very little used. But conditions have changed very much, and I think if we all look around and see the abuse it has been subjected to, we will come to the conclusion that it is time everybody reconsidered the matter. If we just stop to think of how many times we have had to take advantage of the guarantee on the electric appliances in our own homes, we will find it is comparatively few, and most of the devices I have seen and which the customer claims the guarantee privilege

on, I think can be traced to either carelessness or abuse, or else they are not entitled to this thing at all. I have seen so many being dropped on the floor — in fact friends, whose appliances I repair occasionally, tell me that. I think it is a matter which should be carefully considered.

As regards labour charge on this, to the best of my knowledge most guarantee tags which are attached to smaller appliances do not specify that there is any labour to be put on that by the dealer or anybody. They merely guarantee replacement of defective parts, and it really is largely up to the dealer, who feels it either necessary or otherwise, to replace. If he thinks it is so he does it, but really it is a matter for both dealers, contractors and manufacturers, and the whole organization to get together and decide what is the best policy for the continuation of the business.

President:—Any more discussion on this paper?

B. Faraday:—Mr. Chairman, I would like just to refer to Mr. Henderson's remark in connection with guarantee, and also at the same time would like to point out in my opinion that the necessity for the guarantee will disappear when we have developed specialist appliance men who are able to give good service. I know in my own experience, which is rather limited, that a man cannot be diversified in the selling of appliances. To begin with, he has to sell himself, and when he has thoroughly sold himself on a particular appliance, he is then in a position to go out and sell to somebody else. The question of people coming into the store and purchasing them, I am frank to say, in my opinion that day is pretty distant. People come in to pay their regular lighting bills and pass by these appliances all set out in an attractive way, and never look at them. I feel the place to sell them is in the home, and when we are able to specialize and develop salesmen — I mean specialists on one appliance — and their knowledge so develop that they are able to give first class service on that appliance at short notice, I think we will then have arrived at the day when we can merchandise these things successfully.

Mr. Jenkins this morning mentioned some courses that were being made available through the NELA. They are all excellent courses, but I failed to hear mentioned any courses which would make it possible for the development of specialist appliance salesmen, and personally I feel this is a question well worth consideration. (Applause.)

President:—Thank you, Mr. Faraday.

Any more discussion? Mr Atchison have you anything to add to the report?

I will move that this report be adopted. All those in favour?

(Applause.)

Before proceeding to our last report on Street and Highway Lighting, we missed one or two things on our way through. The report of the Underground Systems Committee. Is Mr. Kenyon present?

We also have report of the Rural Lines Committee, Mr. Beaumont. He advised me he was not going to make a report, but I told him he should. I have acted on that Committee, and we both of us kept close in touch with the Rural Lines Committee of the NELA, and we cannot report any progress to date. There does not seem to be any solution of this problem at the present time. In the States they are arranging this with the big farming institutions, and the big farming newspapers, to try to make this service of use to the farmer to the extent where the central station can make money. I think in Canada we cannot lead the way very well. We will have to wait on them to develop that.

RURAL LINES REPORT

The question of giving service to outlying communities and to farms is a matter that in the past few years has received considerable attention, but reviewing the work done by the various committees of the National Electric Light Association and this Association there does not seem to be a very satisfactory solution of the problem as a whole, nor does there appear to be any very recognized standard practice in dealing with the different problems as they arise. As a matter of fact, from the point of view of the utility company the problem generally is a question of how far the relation of the investment to the return can be stretched and still make a profit. The condition of cost, materials, prices that can be paid for power and many other questions that enter make the matter one that has to be dealt with very carefully.

There is after the matter has been biven thought no obvious solution which might be adopted as a means of eternally answering all the different questions raised, and all that can be done by a Rural Lines Committee is to inform the members of the Association of the various ways in which rural lines and such service are being constructed, the charges made for service and steps taken to popularize the use of electricity in communities.

To a certain extent the serving of Rural Committees can be attacked in those districts lying just outside the distribution systems in the smaller towns and villages. It can be done in several ways. In some csaes arrangements can be made with a number of proprietors by which they will share a proportion or the whole of the cost of new equipment required to give them service, and after completion of construction, according to the standards of the requirements of the power company, the equip-

ment can be deeded over to the power company for operation at uniform or other rates to be mutually agreed upon.

Another way of dealing with the problem of cost at times may be found in the construction of single phase lines. Of course this has to be done with great care as the use of a single phase line for power is very limited, and the changing to a three phase line for power requirements involves considerable cost, often to the extent that would make the business extremely unremunerative, the change from single phase to three phase often being forced upon the utility company for public policy reasons that must be satisfied by giving the community complete facilities regardless of the additional cost.

There are other ways in which cost can be reduced, such as the use of 4,000 volts, longer spans, transformers stepping down the voltage from, say 12,500 to customers' voltage 2,200 and 110. In some cases municipalities of the small villages have been willing to give bonuses such as providing the poles and excavation of poles.

In the case of giving lighting service to small rural towns adjacent to the existing distribution systems, it is sometimes found very satisfactory to increase the minimum monthly charge.

While these suggestions do not do much to solve the problem as a whole they are given here with the idea that perhaps in some cases they may be helpful.

Another method of satisfactorily reducing cost is by sharing the use of poles with telephone companies and this has been found to work to advantage in a good many cases.

With regard to publicity work which has at the back of it the idea of getting the farmer to realize the use of electricity on the farm and its economic benefits, at the same time to prepare him to pay such a price for electricity which will render a more reasonable return, steps have been taken in the United States to bring the matter before the professors and students of the various agricultural colleges, and it is recommended to the incoming Committee that this matter be given serious attention and definite steps taken.

Concluding it may be said that so far as the Province of Qubeec is concerned, farm communities are not demanding power for farming purposes as a class, and in such cases where requests are made they do not seem prepared to pay the price.

Another point also is from the utility company that at present the prospects of load from such a source is not very great, and it is more of a question of gradual growth of the demand for this class of service coupled with a continued and careful study of all the various factors involved.

R. J. BEAUMONT, Chairman.

Now we will proceed to the last item on our official programme — lecture by Mr. M. E. Love, Ilumination Engineer of the CGE, on Street and Highway Lighting.

STREET ILLUMINATION.

M. E. LOVE:—The subject of Street Lighting is constantly being brought to the foreground at the present time, which is mainly due to the inadequate illumination in most of our cities and towns to meet the demands of modern trafic.

To appreciate this situation let us consider what we have passed through in the last six or seven years:—

(a) During the war Street Lighting suffered both in operation and development. The general unsettled conditions prevented any changes. The illuminating Engineer was mostly engaged in research work for the government.

(b) The war over the Engineer was once again at work on new developments to meet modern demands. However, here in Canada municipalities were not in a position to consider their lighting problems and consequently the old antiquated lighting remained.

(c) We have now come to the time when it is becoming an absolute necessity for the cities and towns to turn their attention to improving the illumination of their streets. New conditions are imposed upon us, which have changed our requirements entirely. The increased automobile traffic and the ever increasing growth of the moving picture industry encouraging people out at night. The improvement of our highways making driving a pleasure.

It, therefore, must be admitted we have to increase the intensities of illumination to meet the modern demands, if it is nothing else but for a safety point of view.

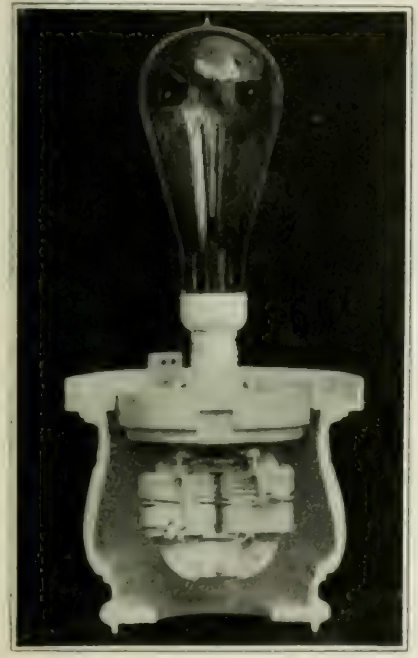
Here in Canada, where power costs are low, with the present day developments and improvements in the art of outdoor lighting, we should lead all the other countries.

Let us consider what we have today which will produce adequate Street Lighting at the minimum cost.

(1) ORNAMENTAL LIGHTING.

In the past the application of ornamental lighting has been confined to chiefly our "White Way" or main business districts. We now have a trend for a much broader application which is extending our ornamental equipment to our parks, boulevards and residental districts.

This has been brought about chiefly by the fact that we now have equipment to enable us to space our units a comparatively long distance apart by controlling the lighting, and confining it mostly to our road surface. This reduces the number of units required and incidentally reduces the capital cost. We can also give some credit for this advancement to the development of the high candle power Mazda Lamps, eliminating the necessity of the three, four and five light cluster units and replacing them with the more stately single light unit.



From E casing for ornamental Novalux fixture, Compensator type.

Today we are using incandescent lamps, from 600 up to 2,500 candle power, for our business districts, and from 250 to 1,000 candle power in our residential districts.

For our down town business district or "White Way" we still maintain a spacing from 80 to 125 feet apart at heights from 14 to 18 feet from road level to light center. There has been a few cases where the mounting height has been increased to 20 and 30 feet, using 2 and 3 high candle powered lamps, and spacing the units 150 to 200 feet apart. However, it is usually considered that lower mounting heights and closer spacing is more desirable to get the real "White Way" effect which is enhanced by the ar

chitecture of the ornamental illuminares. The possibility of glare even with the lower mounting height, which is argued by some, is not serious owing to the surrounding brightness of the show windows and buildings.

For ornamental lighting in our residential, boulevards and park ways we now go to spacing as long as 200 feet with mounting heights from 14 to 20 feet.

Here is where we use a combination of prismatic glassware and an outer globe, which enables us to accomplish this wide spacing, and still maintains an even distribution on our road surface.

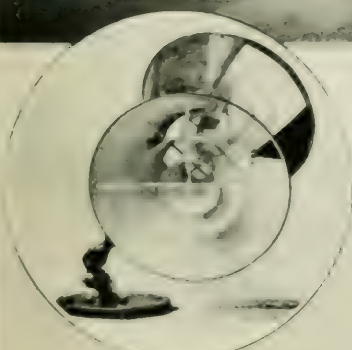
The point is often brought up as to why use an outer globe, why not have the outer globe of prismatic glass and do away with the internal refractor. This has been done on a few installations, but does not give the effect that is really required in street lighting. We find a great tendency toward the opal globe. A great number contending that refractor distribution increases the intensity midway between lamps, and there is not sufficient light in the immediate vicinity of the lighting standard. The opal globe is not open to these objections in the same degree, but it is deficient in revealing obstacles or irregularities in the road surface midway between the units. In these dark regions pedestrians and vehicles proceed with difficulty and a feeling of insecurity.

The combination of a dome refractor and a rippled globe combines the advantages of both the opal globe and the complete prismatic top. Here we will get a higher intensity in the vicinity of the standard, and still maintain an even distribution to discern objects midway between lamps.

This type of globe referred to is one of the most interesting developments in street lighting glassware. The globe is made of a clear rippled glass which has minute ripples on the outer surface. For ornamental lighting this globe is given a thin flashing of opal so as it will have just enough diffusing qualities to reduce the glare to a minimum, and still maintain the direction of the light rays from the refractor. It also adds a pleasing sparkle to the light source giving appearance of life to the unit. In the cases where this glassware is used without refractors, it is usually given a heavier flashing of opal.

We therefore see the ordinary opal diffusing globe is rapidly being superceded.

Within the last year or so there is still another pole top that seems to be coming very popular, the lantern type of illuminare. This type is not altogether new, but perhaps an old idea being revived. Within the last year or so several lantern installations were put in. It embodies all the dasthetic points that can be desired for and it will show a big reduction in maintenance over the large one



Bracket Type Series Highway Lighting Unit

piece globe. Many designs have been put on the market lately, one worthy of note is the Sunnyside installation in Toronto. Here we have a cast bronze lantern embodying glassware similar to the rippled globe. There is also the dome refractor used in this unit. Here we have a further reduction in maintenance owing to the lantern being made of cast bronze, painting being illuminated. It also adds to the asthetic point of view. A 600 C. P. 20 ampere lamp is utilized. A series Transformer bored in the ground by the side of each lamp enables the use of the 20 ampere high efficiency lamp. The entire system is fed from Pole type constant current Transformers which we are about to discuss.

The tendency today is to feed our Street lighting system underground, particularly our Ornamental systems. The first cost is, of course, somewhat higher than that of overhead, but this is soon compensated by maintenance.

The series system which is most common in this country adapts itself exceptionally well to underground work. An No. 8 cable lead covered armoured steel tape is laid in a trench about 12 and 15 inches deep. At each standard it is customary to use a series transformer which enables the use of the twenty ampere high efficiency lamp, also illuminating the series voltage from coming above the ground, or as an alternative an Auto Transformer can be installed in the casing of the unit. The system can be fed from either the Pole type Constant Current Transformer operated by time switches or the station type Constant Current Transformer.

On business streets where trolley poles are already in use it is good practice to mount the lighting unit on a bracket arranged on the trolley pole. In some cases overhead distribution has been used by running a No. 6 cable on the top of the trolley post.

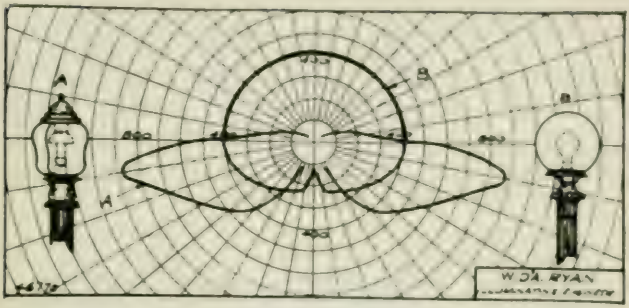
SUSPENSION AND HIGHWAY UNITS.

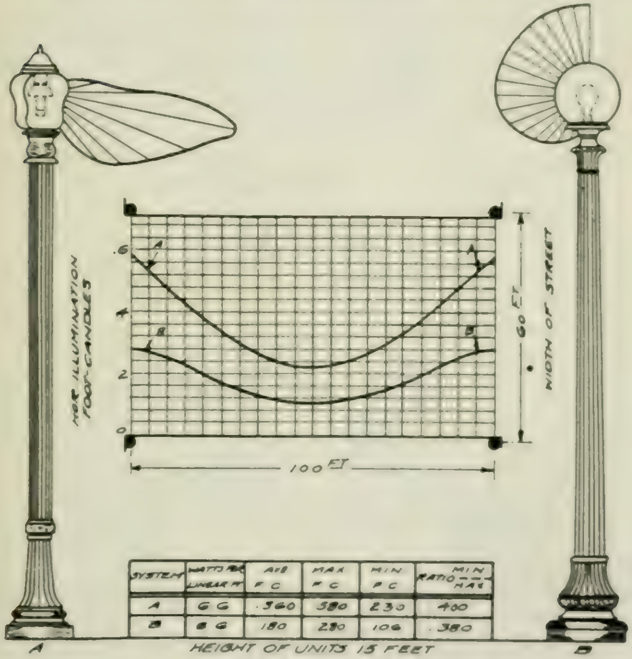
There is still a large field for the suspension unit either suspended on span wires over center of roadway or mounted on Mast Arm.

In connection with this type of lighting our most important problem is that of proper glassware as in the ornamental lighting.

Here we have a condition where we find that invariably the units are placed further apart than the ornamental. It is therefore of great importance to utilize glassware which will control your light.

The same argument can be put forth with regard to using prismatic glassware alone here as in the ornamental, only perhaps even more so. It is, therefore, suggested that the ideal arrange-





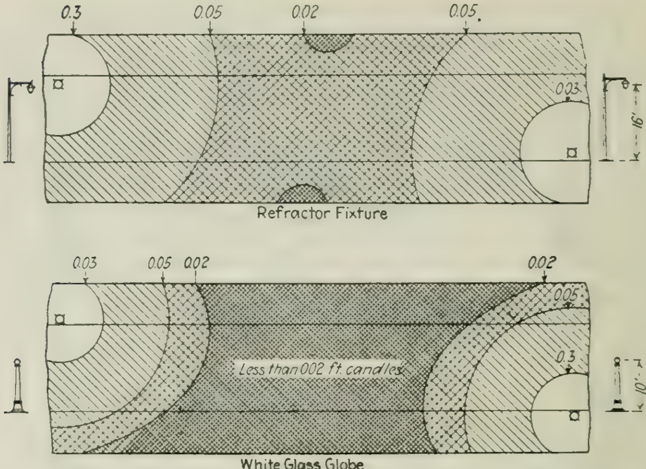
SYSTEM	WATTS PER LINEAR FT	AVE F C	MAX F C	MIN F C	RATIO MIN/MAX
A	6 G	.360	580	230	400
B	6 G	180	280	106	.380

Charts of Comparative Distribution and Illumination

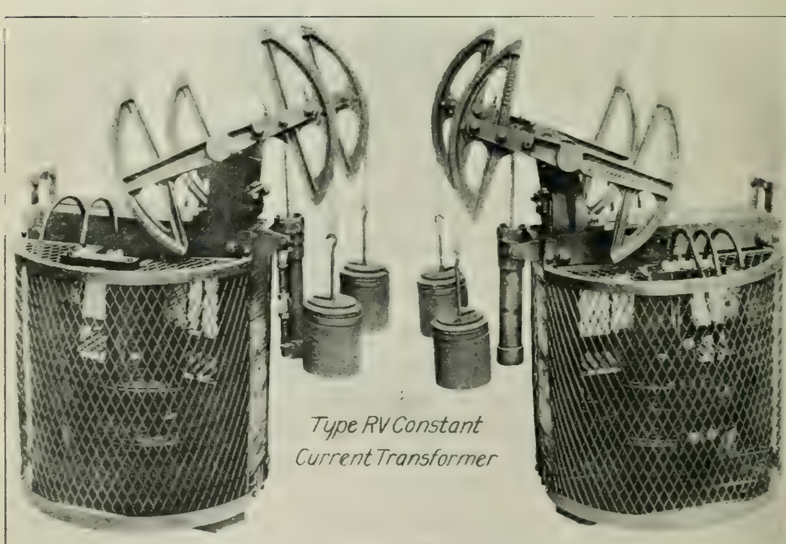
A: Form 8 Novalux ornamental unit, three-section stippled globe, Holophane prismatic dome refractor, with 600-c-p. Mazda C series lamp
B: Novalux ornamental unit, Genco glass ball, with 600-c-p. Mazda C series lamp

Illumination calculated on street surface along center line of street. Height of units 15 ft.

ment is that of the rippled globe and dome refractor, giving a wide distribution and at the same time a high intensity underneath the unit, enabling to see clearly by having a bright background



STREET-SURFACE ILLUMINATION IN FOOT-CANDLES WITH REFRACTOR AND WHITE-GLASS GLOBES



Type RV Constant Current Transformer

On this type of unit an auto transformer can be accommodated in the casing for utilizing the 20 ampere lamp which also protects the lamp from surges due to lines getting crossed.

The unit can be suspended from an utamatic cutout which will entirely sever the electrical connection when the lighting unit is lowered, and at the same time short circuiting the lamp.

Highway Lighting must be handled in an altogether different manner. We have an application different from all others when we are confronted with the lighting of our Highways. We want to confine our light to the roadway only, we do not want to illuminate the neighboring fields. What we have to have to make the lighting of our miles of Highways feasible is a unit which will accommodate a reasonably small lamp, give a wide distribution enabling long spacing, and at the same time a fairly high and even intensity on our road surface. This is necessary to meet the demands of modern motor traffic.

This is being accomplished by the nested parabolic unit which collects the light rays from a 250 Candle Power Lamp, and redirects them up and down the highway only. It is designed for a 250 C. P. Lamp, and when mounted 30 to 35 feet above the road level can be spaced from 300 to 350 feet apart and maintains an even distribution. The result has become known as the "Ribbon of light."

With this type of lighting on our Highways we reduce the glare of the automobile headlights, in fact it is quite possible to drive without headlights at all.

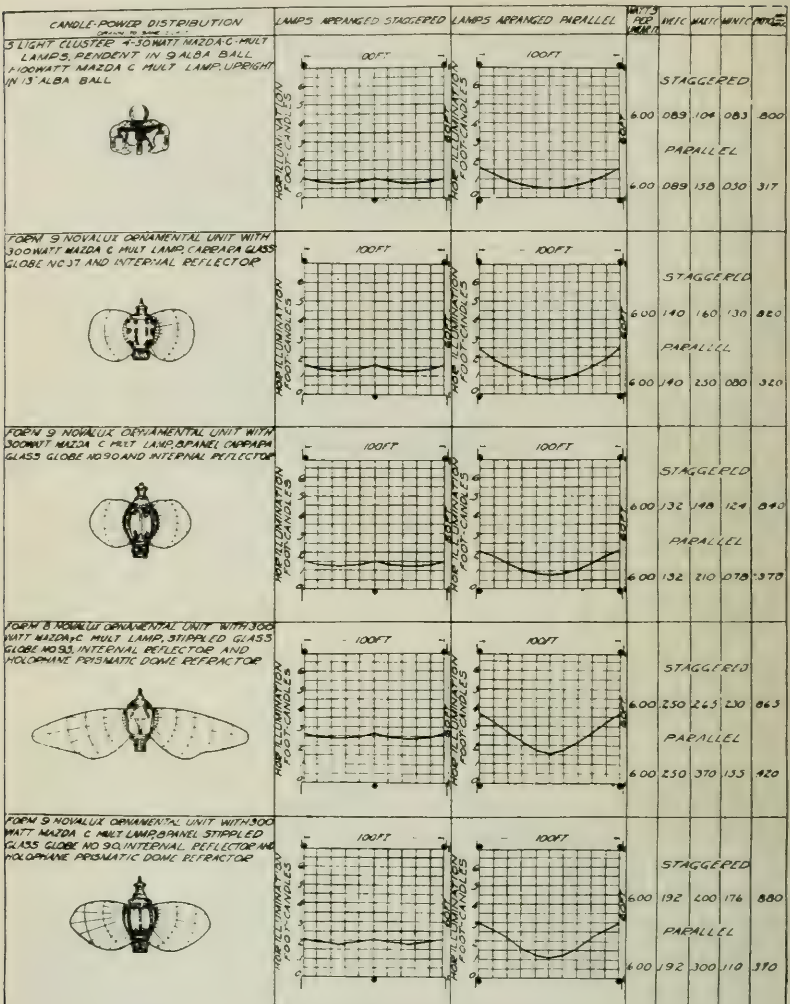
The average automobile owner usually has only the evenings for pleasure driving during the week days, therefore the lighting of our highways are as important as our city streets. Also Express Companies are springing up and are doing a large per cent of trucking at night. Should not this medium of transportation be protected?

At first it was considered by some that the glare of such a unit would be very objectionable, but this is not so, as the illuminating surface of the reflectors offsets the brightness of the lamp and one sees the unit as they would a large diffusing globe.

Some of the advantages of Highway Lighting are as follows:

(1) Prevents accidents.
- (a) By showing up dangerous curves.
- (b) By reducing headlight glare.
- (c) By illuminating signs, sides of road and obstacles.

(2) Adds to comfort of night driving.
- (a) By relieving eyestrain.
- (b) By assisting in making repairs.
- (c) By discouraging holdups.



Comparison of a Cluster Unit and Several Single Units for Street Illumination by the Multiple System

(3 Increases night traffic thereby relieving day congestion.
(4) Decreases running time thereby increases road capacity.
(5) Helps to bring electricity to the farm by providing a pole line.
(6) Increases real estate values.
  (a) By tending to expand city along highway.
  (b) By extending electrical conveniences.

The benefits derived are many, and owing to the long spacing small wattage consumption per lamp, the cost is low. Is there any good reason why at least our main highway should not be illuminated? The money would be well spent if it only accomplished only one of the foregoing claims: The prevention of accidents.

In conclusion I would like to draw your attention to the point brought out in the report of the Street and Highway Division at the N. E. L. A. Convention last year.

Insert—Novalux Fixture, Rippled Globe

Here is mentioned the fact that Street lighting from the Central Station viewpoint is not always a desirable load. It involves a comparatively high investment and yields a relatively low income. It is seldom unattended by disagreement, suspension and lack of appreciation by the part of the city officials. Yet it represents the principal contribution of the utility to the well being and safety of the community. It permits a private interest to participate to an unusual degree in one of the most important works.

As a safety measure Street lighting ranks with police and fire protection.

As a public improvement it ranks with sewage and paving.

As an expression of civic progress it is unequalled. Should a service of such high order be judged purely from a standpoint of investment and returns. It should be financially sound, but will it not yield its dividends in that intangible asset "Good Will." It is part of the entire investment which is not buried underground, or in a substation. It is the visible evidence of municipal electrical service.

PRESIDENT:—I would ask if there is any discussion on Mr. Love's paper? Well, I take it that Mr. Love has covered this question so thoroughly that our members feel there is no need for discussion. I want to thank Mr. Love for his paper. I am glad indeed that he went through the paper as clearly as he did. There might have been some disposition to cut it short, but I am sure every word was worth listening to. I propose a hearty vote of thanks to Mr. Love for presenting this paper. (applause)

Now, gentlemen, to proceed with the obsequies. I want to mention Mr. O'Hara specifically as having been the gentleman who presented the main features of today. I wish you would give Mr. O'Hara a very cordial vote of thanks. (applause).

Also not to forget the various Committees who co-operated in the preparation of the reports. Throughout the year previous to the Convention a lot of work has been done, and I think we may well congratulate our Committees upon the work they have brought forward. (applause).

Finally, it is my pleasure to congratulate all those who so steadfastly stuck by this Convention—by the business sessions. I am sure what they heard will be of value. I hope particularly that they will be so influenced and interested by what they have heard, that they will make a mental resolve without fail to turn up at next year's Convention.

Gentlemen, it is my privilege and pleasure to declare the business section of the Convention at an end, and to ask you to, without fail, attend the Veterans' Night tonight.

(Applause was then given the President).

A. P. DODDRIDGE:—I would like to extend a vote of thanks to the Entertainment Committee. I think we are highly indebted to the members of that Committee. I am sure their work has been very well carried out, and everybody enjoyed the entertainment provided, and I would like to put it on record that a vote of thanks be tendered them. Seconded by Mr. O'Brien. (applause)